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ABSTRACT

This book, which was written for students, explains the education and training needed to obtain one of the 50 most appealing and best-paying jobs today. Jobs are grouped into these categories: business services; communications; computer technology; construction; health care; manufacturing and production; mechanics, installers, and repairers; professional services; and transportation. Each job description includes information about some or all of the following: personality traits required for the job; job outlook; job duties; working conditions; requirements for obtaining a job and advancing in the occupation; average salaries for entry-level and advanced jobs; additional information sources; and interesting fact(s) about the job. The following are among the jobs profiled: manufacturer's and wholesale sales representatives, restaurant and food service managers, securities and financial services sales representatives, graphic artists, library technicians, computer and office machine repairers, computer programmers, computer scientists, drafters, construction and building inspectors, electricians, engineering technicians, plumbers and pipefitters, clinical laboratory technologists and technicians, dental hygienists, dispensing opticians, licensed practical nurses, occupational therapists, nuclear medicine technologists, electrical technicians in manufacturing, machinists and tool programmers, tool and die makers, water and wastewater treatment plant operators, mechanics, elevator installers and repairers, electronic equipment repairers, designers, paralegals, teachers, science technicians, aircraft mechanics, aircraft pilots, automotive technicians, and diesel engine technicians. Concluding the book are lists of sources of additional career information and eight vocational student organizations. (MN)

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# HIGH-SKILL, HIGH-WAGE JOBS

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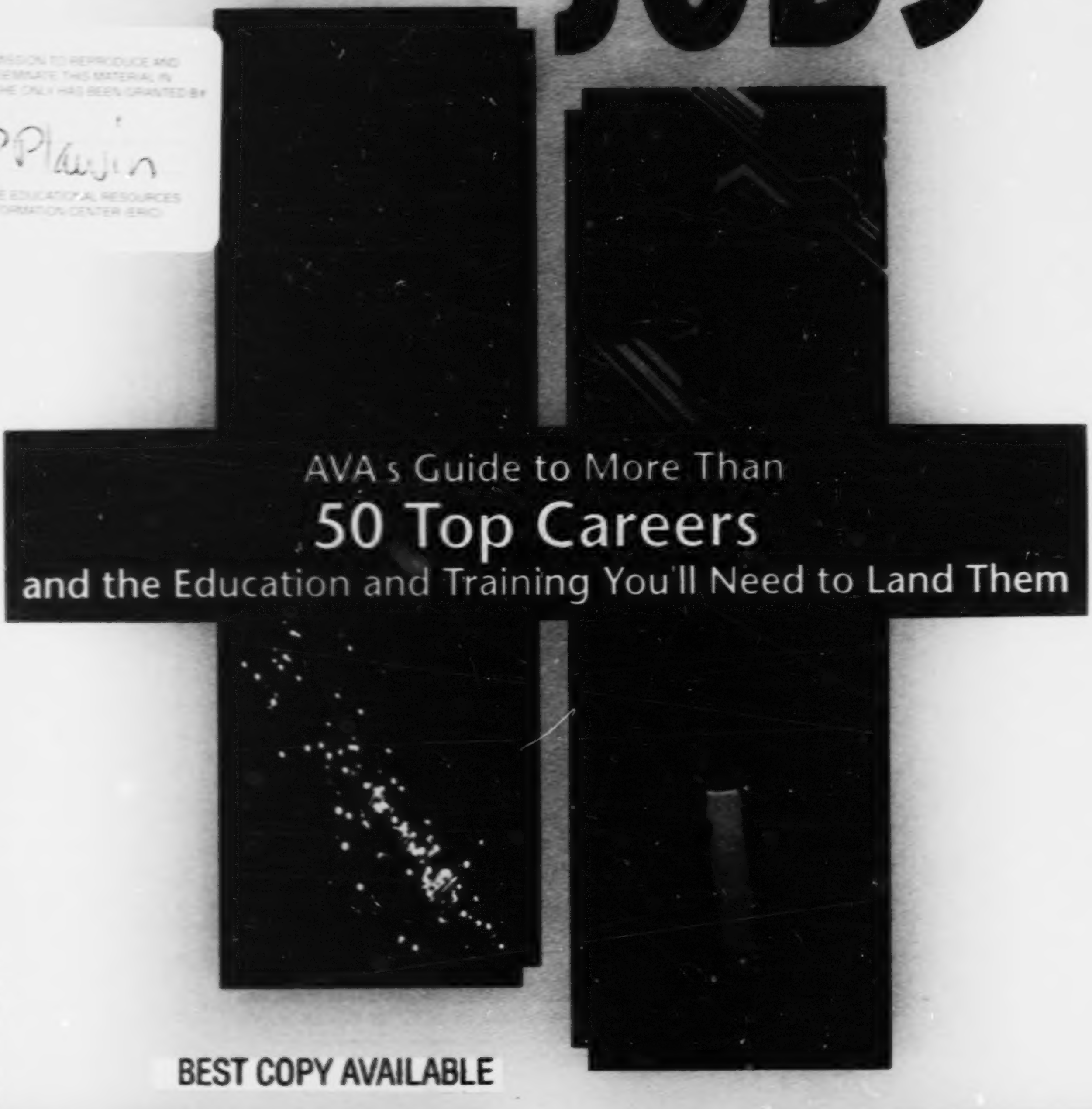

## AVA's Guide to More Than
## 50 Top Careers
## and the Education and Training You'll Need to Land Them

CE 078 172

by Kristen J. Amundson

# HIGH-SKILL, HIGH-WAGE JOBS

## *AVA's Guide to More Than 50 Top Careers and the Education and Training You'll Need to Land Them*

Kristen J. Amundson, Writer
Eric Ries, Editor

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# INTRODUCTION

What do you want in a career? Even if you don't know exactly what kind of job you see yourself in after you graduate, you probably want it to be in a career field where you can earn a good living—and that means a great place to live, a car, money for dining out and vacations, and something to salt away in investments.

With those goals in mind, AVA has published this guide to some of the most appealing and best-paying jobs available in today's dynamic and highly competitive job market.

This book was written for students. It zeroes in on your concerns. With subject headings like "What's It All About?", "What's It Really Like?", "How Do I Get a Job and Advance?" and "How Much Money Will I Make?", we answer all your key questions—and tell you where to follow up if you want to know more. In these pages you won't get just a bunch of dry facts—you'll get a real sense of day-to-day life on the job, the latest available salary information, and comments from real workers in the field to help guide you. You'll be able to see how you'd fit into an employer's organizational structure and how you could move up.

The 50-plus jobs in this book are all either out there on the cutting edge or at the very heart of our national economy. Few of these jobs require a four-year college degree, at least to start out. Most call for some education and training past high school, though. Vocational-technical coursework in high school can help prepare you for each and every one of these desirable careers.

At the beginning of each description are questions you can ask yourself to help see if the job's really for you. Then read more about whether it suits your interests and makes the most of your abilities. The key to a successful career decision is getting the facts—the real story—then figuring out how your education can put you on the highway to a high-skill, high-wage career.

## ABOUT THE AUTHOR

Kristen J. Amundson is president of KJA Communications, an educational communications business in Alexandria, Virginia, that develops and writes educational materials for school administrators, school board members, parents, teachers and students. A school board member and former teacher, she has written books or monographs on parental involvement in education, reading, teaching values and ethics and preparing students for the 21st-century workplace.

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# Business Services

# Manufacturers' and Wholesale Sales Representatives

**Do you like to travel?**

**Are you as good a listener as you are a talker?**

**Do you want the freedom to set your own hours and plan your own work?**

There's a time-honored saying that goes, "Nothing happens until someone sells something." That, in a nutshell, is the story of the free enterprise system. Salespeople built our nation's economy. The inventions of Thomas Edison, George Westinghouse and Alexander Graham Bell would have been useless if people hadn't learned about them, bought them and used them. Mass production is impossible without mass selling.

That's what manufacturers' and wholesale sales representatives do. Manufacturers' representatives are in business for themselves and work directly with manufacturers. Wholesale sales representatives work for wholesalers—companies that sell products in large quantities to retail stores and industrial and commercial users. Both types of salespeople interest customers in their companies' products and take orders. Increasingly, they also act as problem solvers, making sure their customers get the goods and services that are right for their business.

## What's It All About?

Manufacturers' and wholesale sales representatives spend much of their time traveling to and visiting with prospective buyers and current customers. During a sales call, they talk with customers about their needs and describe how their products meet those needs. They may show samples or catalogs that describe all the products their company manufactures. They quote prices and let the customer know when the product can be delivered.

Today, sales representatives are most valuable to their customers for the knowledge they provide. They answer questions about their product line: Does this come in other colors? What styles are available? Does it come with a guarantee? The best sales representatives also learn as much as they can about their customers' businesses, and then try to match the products they sell with their customers' needs.

"I sell commercial flooring," says Mario, a wholesale sales representative. "I can best help my customers if I understand that the kind of floor a hospital will install in an operating room is very different from the floor they'd install in their front lobby."

But the salesperson's job is not finished once the sale is completed. Sales representatives keep in touch with their customers to make sure they are satisfied with the product they bought. They may make follow-up visits to ensure the equipment is functioning properly. Many sales representatives also act as trainers. A company that invests in an expensive piece of machinery, for example, will want someone to train workers to use it correctly. The sales representative's relationship with the customer is one of ongoing service.

## Job Outlook

**A 10 to 20** percent increase, to **1.7 to 1.9** million jobs, by 2006

Sales representatives must analyze statistics, prepare reports and handle administrative duties, such as filling out their expense account reports and making travel plans. In addition, sales representatives must manage their business. They need organizational skills as well as knowledge of accounting, marketing and administration.

To be a good sales representative, you should:

- Value independence. As a sales representative, you'll have to set your own hours and create your own business opportunities.
- Have drive, determination and an adventurous spirit.
- Be interested in the needs of others. "I can tell a good salesperson from a weak one in a minute," says one expert sales trainer. "The good salespeople are as talented at listening as they are at talking."
- Speak well. Words are the tools of a salesperson; if you're going to be successful in this field, you need to know how to think quickly and express yourself clearly.
- Enjoy solving problems.
- Be reliable. Customers depend on you. If you say your product is going to be there on the 16th, you need to make sure it arrives on the 16th.
- Be enthusiastic. You need to make a prospective customer as excited about a new product as you are.
- Have perseverance. Sometimes, despite your best selling efforts, customers will say no. You have to have the kind of personality that will allow you to call that customer again and again until you win the sale.

## What's It Really Like?

Wholesale sales representatives are usually assigned by the company to cover a certain geographic area, or "territory." In some cases, this territory can cover several states. Manufacturers' representatives cover territories, too. As they are in business for themselves, however, they often represent several manufacturers.

Since sales representatives go to their customers, they may be on the road several days each week. Within their territory, sales representatives are their own boss. That means a lot of freedom. In fact, a survey of successful sales executives found that freedom is what they value most about their career.

There can be a down side to all this independence, of course. There's often no one to call on for backup if a problem arises. "Sometimes you feel as though you need to be in three places at once," says Stephanie, who represents a building products company. "That's when you really rely on your cell phone and your e-mail."

Hours can be long and unpredictable, but since sales representatives determine their own schedule, they can usually arrange their appointments so they can have time off when they need it. Dealing with different types of people can be demanding, but also stimulating. Many companies set a sales quota—a specific selling goal the representative is expected to meet. Because all or most of a sales representative's income comes from commissions (a percentage of total sales), there's always pressure to produce.

## How Do I Get a Job and Advance?

Many high schools offer distributive education courses that give students a chance to combine on-the-job experience with classroom training. Vocational student organization and service club activities, and summer jobs, that involve selling also are great ways to get sales experience.

You don't need a college education for all manufacturers' and wholesale sales representative jobs. But, because in most cases you will need to explain the technical side of the products you sell, a college degree will give you an advantage. A nationwide survey of sales managers recommended that salespeople should study:

- English—both spoken and written communication
- psychology
- business organization and management
- consumer economics
- marketing procedures and techniques
- fundamentals of selling
- techniques and uses of marketing

Most companies have a training program in which trainees learn about the products they will sell. This is often followed by some on-the-job training in the field.

Because up-to-date information on products is so important, sales representatives are constantly learning. Many companies sponsor meetings so their sales force can learn about new products and developments in their industry. In addition, manufacturers may send out audiotapes or videotapes that help sales representatives stay on top of the latest additions to the company's product line.

If you are promoted, you often will be assigned to a larger account or territory, where commissions are likely to be higher. Those who have good sales records and leadership experience also may become a sales supervisor or a district manager. Some wholesale sales representatives go into business for themselves as manufacturers' representatives.

## How Much Money Will I Make?

The typical manufacturers' or wholesale sales representative earns between $24,900 and $51,900 per year. The top 10 percent can earn $75,000 or more.

Wholesale sales representatives usually earn a salary and a commission. They also receive an expense account to cover the cost of their hotels, travel and meals. Manufacturers' representatives, being self-employed, make their living entirely from commissions and must pay for all their travel expenses.

Some companies offer incentives such as free vacations to top sales representatives.

## To Learn More

Information on sales and marketing careers is available from Sales and Marketing Executives International, Statler Office Tower, Suite 977, 1127 Euclid Ave., Cleveland, OH 44115 (www.smei.org).

Information on manufacturers' agents is available from the Manufacturers' Agents National Association, P.O. Box 3467, Laguna Hills, CA 92654; (949) 859-4040 (www.manaonline.org).

### Did You Know?

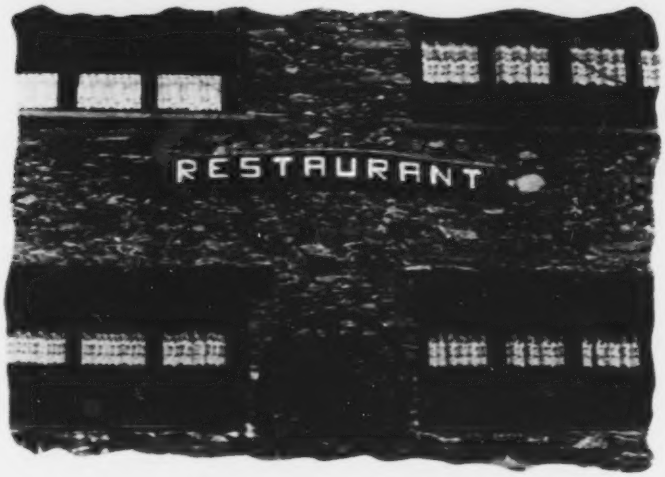
**In some cases, sales representatives work with technical experts to make sure they recommend the right product.**

# Restaurant and Food Service Managers

**Do you like directing and overseeing projects?**

**Can you motivate people to get a job done?**

**Are you a problem solver who can keep track of lots of details?**



Where did you eat today? If you're like most Americans, at least one of your meals was probably eaten away from home. Whether you grabbed lunch in the school cafeteria or stopped for a burger at a fast-food restaurant after school, you were probably one of the millions of people who ate in a restaurant or an institutional food service facility.

And, though you might not have been aware of it, in each of those food service facilities, a restaurant or food service manager was at work. If you want a career that involves lots of contact with people, and if you are interested in a job that involves working around food, this may be a career for you.

## What's It All About?

Restaurants are about a lot more than food. They're businesses, and some of them take in millions of dollars a year. In order to stay in business they must be run efficiently. That's the job of restaurant and food service managers. They select and appropriately price menu items, use food and other supplies efficiently, and work to make sure the restaurant achieves consistent quality in food preparation and service. They also see to the thousands of details that go into running a food service operation, from ordering supplies to recruiting and training workers.

One of the most important jobs of the restaurant manager is to make sure there's food to serve. Some restaurants serve almost the same menu every day. Others change their menu daily.

In either case, the manager needs to estimate how much food will be needed. Then he or she places orders with suppliers and schedules the delivery of fresh food and beverages. The manager receives and checks the contents of deliveries to ensure that the meats, poultry, fish, fruits, vegetables and baked goods are of high quality.

The restaurant also needs supplies like silverware and tableware. Managers check with suppliers to replenish the stocks of those items, as well as cleaning supplies, cooking utensils and furniture and fixtures. They arrange for repairs of any equipment that breaks down and contract with suppliers to provide services like waste removal and pest control.

In most restaurants and institutional food service facilities, the manager is assisted by one or more assistant managers. In the largest establishments, as well as in restaurants that offer fine dining, the management team may include a general manager, one or more assistant managers and an executive chef. The executive chef is responsible for the kitchen, while the managers look out for the service in the dining room and other areas of operation.

In other establishments, restaurant

## Job Outlook

**A 28 percent** increase, to **631,000** jobs, by 2006 and food service managers supervise the kitchen and dining room. They oversee food preparation and cooking, examine the quality and portion sizes to make sure dishes are prepared correctly. They also investigate customers' concerns about the quality of the food and, if necessary, take action to correct the problem.

Sanitation is a constant concern in a restaurant. Managers direct the cleaning of the kitchen and dining areas. They make sure all tableware, kitchen utensils and equipment are clean enough to meet the exacting standards of both the company and the government. A restaurant that doesn't meet high standards for cleanliness can be closed down.

The record keeping that used to be a huge part of every food service manager's job has been made a lot easier in the computer era. Point-of-service systems are used in many restaurants. When the server keys in the customer's order, it is immediately sent to the kitchen so preparation can begin. The same system totals checks, acts as a cash register and credit card authorizer and tracks daily sales. Some systems also compare daily sales with a record of the restaurant's current inventory. That way, if supplies are running low, the manager knows to contact the supplier.

## What's It Really Like?

It takes a lot of people to prepare and serve food, and restaurant managers devote a lot of their time to hiring and training employees. Especially when the economy is good, it can be hard to find dependable employees. Often, workers can earn higher salaries at other businesses. If there aren't enough employees, the manager may need to fill in—cooking, clearing tables or serving food and beverages.

"One of my never-ending jobs," says Carol, who owns her own bagel restaurant, "is keeping my shop running. This is a high-turnover business, so I'm always on the lookout for dependable people." Managers interview, hire, and, when necessary, fire employees. They may attend career fairs or advertise in the newspaper for employees. Others post signs in the window to attract customers or passersby who might be interested in joining the staff.

In a well-run restaurant, everyone works as part of a team, pitching in to do what's necessary to serve customers. That's an attitude that comes from the manager—if he or she is willing to clean tables, wipe spills from the floor or carry food to a table, other employees are more likely to follow suit.

Most managers work long hours. People eat out in the evening and on weekends, so that's a time when restaurant managers need to work. Those who manage institutional food service facilities like office or school cafeterias work more regular hours.

Even when managers are off duty they may be called in to substitute for someone who doesn't show up. On the job, there can be a lot of stress. Getting hundreds of meals prepared and served quickly is a challenge. During peak hours, the job can be hectic.

Still, some people say they thrive on the excitement. They also say the enjoy the feeling of being part of a team. At the end of the day, there's a lot of satisfaction from serving good food to people who enjoyed their meal.

## How Do I Get a Job and Advance?

Many people are promoted to managerial positions, especially to management trainee, after working as a waiter or chef or in another food and beverage job. But most food service management companies also look for graduates of two- and four-year hospitality management programs. Colleges and universities, vocational and technical schools and community and junior colleges all offer associate and degree programs in this field.

Students learn about food—they study nutrition and food planning and preparation. But they learn about business, too, taking classes in accounting, business law and management and computer science. Some programs combine classroom and lab study with internships that give students some real-world job experience. (In high school, students should take classes in such subjects as nutrition, business and accounting.)

After trainees are hired, they're usually put through a rigorous training program. They receive instruction and gain work experience in all aspects of the operation of a restaurant or institutional food service. From food preparation and nutrition to sanitation and security, these training programs give management trainees the skills they'll need on the job.

Many managers today are seeking certification as a food service management professional. This voluntary certification program, which includes a written exam and work experience, is recognized and valued by employers.

## How Much Money Will I Make?

[illegible]s for restaurant and food ser[illegible]gers vary according to their [illegible]lities and the size and type of [illegible]blishment. The average base salary [illegible] $30,000, but managers in the largest restaurants and institutional food service facilities have salaries in excess of $50,000. Besides a salary, most managers receive a bonus, typically between $2,000 and $10,000.

## To Learn More

For information on a career as a restaurant or food service manager, a listing of two- and four-year college programs in restaurant and food service management or information on certification as a food service management professional, contact the Educational Foundation of the National Restaurant Association, 250 S. Wacker Drive, Chicago, IL 60606 (www.restaurant.org).

For information on becoming a franchise owner, visit www.franchisesolutions.com and its related business links.

### Did You Know?

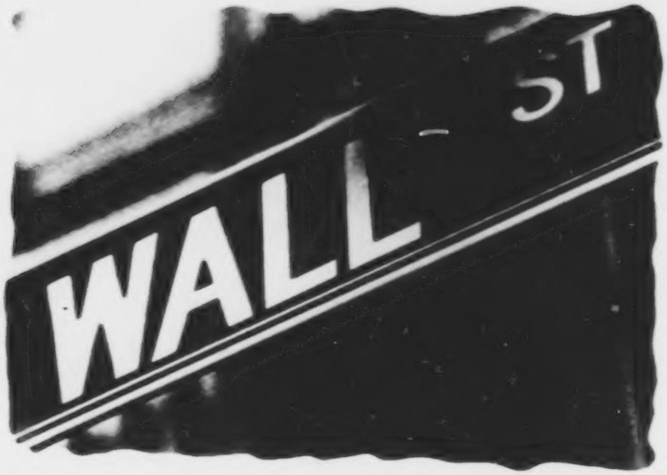
**The 1995** Consumer Ex**penditure** Survey, conduct**ed by the** Bureau of Labor **Statistics,** found that the **average** American spends **about $681** each year on **food** away from home.

# Securities and Financial Services Sales Representatives

**Do you enjoy selling things?**

**Are you a good listener?**

**Can you handle rejection?**



*"On Wall Street today ..."*

How many times have you heard those words on a news broadcast? Millions of Americans have invested money in the stock market. The people who actually handle their financial transactions—buying or selling stocks, bonds, shares in mutual funds, insurance annuities or other financial products—play a major role in keeping our nation's economy growing and in helping people meet their financial goals.

## What's It All About?

Suppose your grandmother dies and leaves you a little money. You could spend it today or invest it so you'd have money to pay for college or buy your first home. You want to know where to invest your money so the amount will grow. And you need someone to handle the actual purchase.

You'd probably turn to a securities and financial services sales representative. These advisers—who also may be known as stockbrokers, registered representatives or account executives—will handle the purchase. Here's how it works:

Your broker sends the order electronically to the floor of a securities exchange, such as the New York Stock Exchange. (Securities are certificates of ownership such as stocks and bonds.) Many stocks are traded on the floor of these exchanges, with one broker saying, for example, "I have 100 shares of General Electric for sale at $85 a share," and another broker saying, "I have a client who wants to buy 100 shares of General Electric." When someone who owns the desired stock is willing to sell at the price the buyer is willing to pay, the transaction takes place.

Ownership of bonds also can be transferred from one owner to another. As is the case with stocks, buyers go through brokers and dealers. When the buyer and seller agree on a price, a transaction takes place.

Not all stocks are traded on a stock exchange. This is particularly true of stocks in the newer, high-tech companies. So if you want to buy shares in the hottest Internet company, your broker might send the request directly to a computerized trading program, which would match your desire to buy stock with someone else's desire to sell it.

But handling the mechanics of buying and selling stock is just one part of the job of securities and financial services sales representatives. They also explain the meaning of stock market terms to clients; offer financial counseling; and help clients develop their own financial portfolio, including insurance, stocks, bonds, mutual funds and other investments. They'll recommend a specific stock or mutual fund.

Within this field there are several spe-

## Job Outlook

A 38 percent increase, to 363,000 jobs, by 2006. As more people think about retirement, establish trust funds, plan for their children's education and learn about investments, job opportunities for people in this field should continue to be excellent.

cialty areas. *Securities sales representatives* sell stocks, bonds and mutual funds. *Financial services sales representatives* sell banking and other services—lines of credit, certificates of deposit, or sales or inventory financing, for example. As more and more banks move into offering more services—you can now purchase stocks at your bank—the job of a financial services sales representative is becoming more complex. *Financial planners*, meanwhile, help individuals and businesses create a financial plan designed to meet their individual needs. Financial planners must have a strong knowledge of tax and investment strategies, insurance, pension plans and securities.

All these jobs turn on the relationship between the sales representative and the client. "This job involves selling," says Margit, a securities sales representative and certified financial planner. "But even more, it involves listening. Different clients have different financial goals. A widow who inherits a small amount of insurance that she has to live on for the rest of her life will obviously be less willing to take chances with that money than a 22-year-old who is investing her first bonus." So if you call your broker and ask whether you should buy a specific stock, you should get an answer that is based on your specific needs.

## What's It Really Like?

Most securities and financial services representatives work on commission—the more they sell, the more they make. That means they need to develop a customer base. Beginning securities sales representatives spend most of their time looking for clients, even relying on "cold calls" (telephone calls to people who did not request them). Many get clients by offering seminars to people who want to learn more about investing.

The job is highly competitive, and if you can't establish a large enough client base, you'll probably have to leave the occupation. But once they are established, most securities sales representatives enjoy both the income they earn and the opportunity to help clients.

"The satisfaction in my job comes from helping people meet their financial goals," says Margit. "Helping a divorced mother accumulate the money she'll need to send her child to college or helping the self-employed person get the resources to retire comfortably is tremendously rewarding."

The job can be hectic. If there is an unanticipated change—employment figures shift, a new anti-cancer drug is brought to market—many clients may want to buy or sell quickly. The pace is less likely to be hectic, however, for those who work at banks, providing service to walk-in customers.

## How Do I Get a Job and Advance?

Today's economy is complex, and securities and financial services sales representatives need to understand as much as they can about economic trends and conditions. A four-year college degree is increasingly important for those interested in entering this occupation; few employers require a specific major, but courses in business administration, economics and finance are helpful. And computer skills are a must, as this industry is highly automated.

Personal qualities are important, too. Employers are looking for people who have good sales ability and communication skills. Self-confidence is also important, since you are likely to be rejected by potential customers many times at the start of your career.

For those reasons, many people come to this industry after holding another job. Typically, people start in this field as an intern or trainee. This may include classroom instruction on such topics as securities analysis, effective speaking and selling. It also gives trainees exposure to different sides of the business.

All securities sales representatives must be certified, which usually involves passing an exam and, in some cases, furnishing a personal bond. Once on the job, you can look forward to constant education and training. As a new segment of the economy heats up, or a new financial product is introduced, you need to understand it before you can recommend it to your clients.

Generally, people advance in this field by taking on more clients and handling clients with larger accounts. Some advance to top management or become partners in their firms.

## How Much Money Will I Make?

The average earnings for securities and financial services sales representatives is $38,800. Top producers, however, can earn much more—the top 10 percent in salary earn an average of $98,000. Earnings depend on commissions from the sale or purchase of stocks and bonds, life insurance and other securities. These are likely to be higher when there is much buying and selling going on and lower when there is a slump in market activity. Financial services sales representatives are more likely to be paid a salary, with some earning a bonus if they reach certain sales goals.

## To Learn More

Information about job opportunities as a securities sales representative is available from the personnel department of individual securities firms. For information about job opportunities for financial services sales representatives in various states, contact the state bankers association or write directly to a particular bank.

For general information about the securities industry, contact the National Association of Securities Dealers, 1735 K St. NW, Washington, DC 20006; (202) 728-8000 (www.nasd.com).

### Did You Know?

**About two of every five people in the United States own stock in corporations.**

# Wholesale and Retail Buyers

**Can you often spot buying trends and tell what the "next big thing" is going to be ?**

**Can you make quick decisions and accept responsibility for them?**

**Do you work well under pressure?**

Imagine if every time you went into a record store to buy a CD by your favorite artist, you couldn't find any on the shelves. It wouldn't be long before you'd stop going to that store—and it would probably be only a little while longer before the store closed its doors permanently.

Making sure customers find the products they want to buy at a price they're willing to pay is the responsibility of wholesale and retail buyers. It's an exciting, pressure-packed career that accounts for more than $2.2 trillion in annual sales (1994) in the United States alone.

## What's It All About?

Buyers are the people who decide what you'll find on the shelves of the stores. They determine which products are best and most likely to appeal to consumers, negotiate the lowest price, then write contracts to make sure the right amount of goods is received at the right time.

Retail buyers are the people who make purchasing decisions for grocery stores, drugstores, clothing stores and other retail establishments. Wholesale buyers, on the other hand, purchase goods directly from manufacturers or from other wholesale firms. Then they resell them to retail firms, commercial establishments and other organizations.

Buyers look over previous sales records to figure out what products have sold in the past, and in approximately what quantity. (It's a pretty safe bet, for example, that grocery stores should stock up on turkeys in November and on ice cream in July.) They check ads in newspapers to see what their competitors are selling, and at what price.

Buyers also need to keep careful track of what's selling well, so their store doesn't run out. Technology has made that part of the job a lot easier. Cash registers connected to computers—known as point-of-sale terminals—make it possible to keep track of everything that sells almost as soon as the sale is rung up. Some stores also link their computers with their suppliers so the suppliers know quickly what they should continue to send to stores—if the blue shirts aren't selling but the red ones disappear as soon as they're put on the shelves, the supplier knows it's time to send more red shirts.

But buyers also have to make decisions about what purchasers would like to buy in the future. They need to check economic conditions to see whether consumers are likely to be in a buying mood. They attend trade shows so they can find out what's new in their industry. They conduct research—many buyers form "focus groups" of consumers who react to products the buyers are thinking about purchasing. Instinct plays a role, too, since buyers sometimes

### Job Outlook

**Employment** should remain **steady at about** 183,000 jobs **through** 2006.

need to trust their ideas about a new product that will appeal to consumers.

It's a job that involves some risk. Buyers who can figure out what's going to appeal to consumers, whether it's Beanie Babies or whatever, can make excellent profits. Those who guess wrong, however, stand to lose a lot of their employer's money—and perhaps even lose their job.

Buyers who work for large- or medium-size firms usually specialize in one or two lines of merchandise—men's dress shirts and ties, for example. Buyers for small stores may be responsible for buying the store's entire inventory.

Once buyers decide what to purchase, they need to negotiate to make sure their store gets the items when they're needed and at the lowest possible price. Before signing a contract, they may want to visit a supplier to make sure the company can really provide the goods ordered.

## What's It Really Like?

To be successful in this job you need to develop an understanding of the customer's wants and needs. You need to be good with people, since a large part of your job involves communicating and negotiating with them.

You need flexibility. During a single day, you may speak with suppliers on two continents, talk with a store clerk about displaying merchandise so it will sell, and track down a late shipment. And you need to be able to respond to consumers' constantly changing needs. The color that looked so fresh last spring may seem tired a year later. The shoes everyone was clamoring for in January may be marked down to half price by July.

You need to be decisive and self-confident—able to make quick decisions and then stand by them. And, if one of the products you decided to buy isn't successful, you need to know how to minimize the negative impact on your store or your department.

You need analytical and technical skills. Most of the retail industry is computerized, so you need to know everything from spreadsheets to word processing. You also need to know how to analyze technical data in suppliers' proposals and how to perform financial analysis.

Finally, you need stamina. Most buyers work long hours and most travel at least several days a month. Because the Christmas season is so critical to most retail businesses, you can expect never to have a day off between Thanksgiving and Christmas.

## How Do I Get a Job and Advance?

This is a field where experience is as important as education. Most buyers start as trainees, purchasing clerks, junior buyers or assistant buyers. Generally, you need four or five years of experience to become a buyer.

How much education do you need? It varies with the size of the organization. In larger businesses, a bachelor's degree or even a master's degree is a definite plus. The courses you take should include marketing, communications, finance, management, merchandising and information systems.

You can start preparing for a career as a buyer while you're still in high school. Sign up for business or retailing courses, especially those that offer work-study opportunities. There, you'll have the opportunity to work in a variety of retail settings. Participation in clubs like DECA [Distributive Education Clubs of America] also will prepare you for a career in retailing.

Take every opportunity to work in stores, since buyers need to understand the specifics of their particular business. A chance to work on the sales floor, whether it's during summer vacation, the Christmas holidays or as a part-time job during the school year, will give you first-hand contact with customers so you can start to see what they like and don't like. It also allows you to observe stock routines, keep inventory records, work a cash register, write up sales, handle returns and exchanges and arrange the merchandise.

Once you're hired, you'll probably start by selling merchandise, supervising sales workers, checking invoices on material received and keeping track of stock on hand. Gradually, you'll be given more responsibilities for making purchasing decisions.

Buyers can advance to become an assistant purchasing manager in charge of a group of purchasing professionals. Or, they may be promoted to a department with a larger sales volume. Merchandise managers may move higher in the company—ultimately up to corporate vice president for all buying.

## How Much Money Will I Make?

The average salary for wholesale and retail buyers is $33,200. However, top performers can earn nearly twice as much—the top 10 percent of earners have salaries of more than $63,000. One benefit to this occupation is that you may receive discounts on merchandise you buy from your employer.

## To Learn More

For further information about education and training for buying careers, contact the American Purchasing Society, 30 Downer Place, Aurora, IL 60506 (www.american-purchasing.com).

For more information on buying careers in retail establishments, contact the National Retail Federation, 325 Seventh St. NW, Suite 1000, Washington, DC 20004 (www.nrf.com).

### Did You Know?

**The retail industry employs more than 20 million workers, or one in five American workers. There are more jobs in retailing than in the entire U.S. manufacturing sector.**

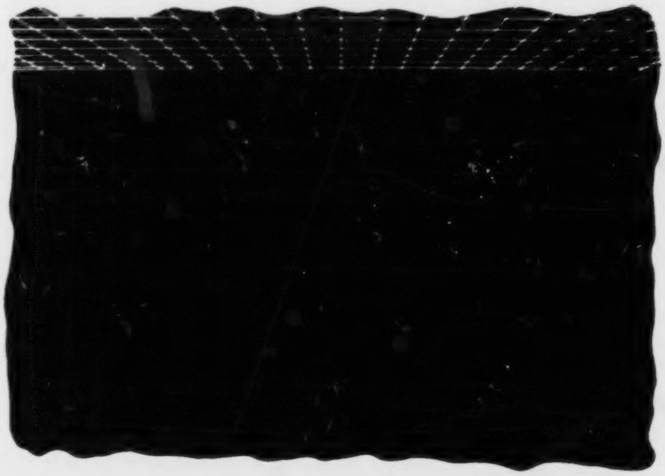
# Communications

# Graphic Artists

**Do you enjoy communicating ideas through pictures and other graphic images?**

**Do you like working with computers?**

**Do you work well with people?**



What initially attracted you to this book? Was it the colors on the cover? Did you like the way the pages were laid out? Did a particular icon or typeface catch your eye? In any of those cases, whether you knew it or not, you were responding to the work of a graphic designer.

From the box of cereal from which you poured your breakfast this morning; to the logo of your favorite fast-food restaurant; to the way your history book combines words, pictures and charts; you are surrounded by the work of graphic artists. And the growth of the Internet is opening up broad new opportunities for graphic artists, as companies and organizations create Internet content that reflects who they are and what they do.

## What's It All About?

We live in an information age. But with so much information available it's sometimes hard for people to absorb it all. That's why graphic artists are so valuable. They know how to present information in a way that is visually appealing and interesting.

Graphic artists are responsible for the design of almost everything you see. They may design a brochure to introduce a new benefit or service. They decide how to make a corporation's annual report eye-catching. They create charts and other illustrations for magazines, newspapers, brochures and books. They design the covers of your favorite CDs, choose the color of the can that holds your favorite soda and create the graphic that introduces your favorite TV show. Major corporations, retail stores, magazines and advertising agencies are just some of the clients that rely on graphic artists.

In the past, graphic design was a hands-on job. Graphic artists worked at large tables, gluing printed text and photographs to large pieces of cardboard. Today, most graphic designers spend their days in front of a computer screen. It's not unusual for an artist to receive copy by e-mail, design the project on a computer, send an electronic image of the project to the client for review, then give the finished job to the printer on a computer disk. The first time today's graphic artist may touch a piece of paper is when the finished brochure or magazine comes off the printing press.

## What's It Really Like?

"When I first came out of art school," says Annemarie, who has run her own business for more than 20 years, "I thought of myself primarily as an artist. I soon realized that my job is to help my clients express their thoughts and ideas. Even if I think green is the right color, if the client wants red, we'll print in red."

Unlike fine artists, who produce art to

## Job Outlook

**An increase** of 21 to 30 percent, **to 354,000** jobs, by 2006. **Opportunities** for designers **who want to design** Web pages **or other online** art are especially **good.**

satisfy their own need for self-expression, graphic artists use their skills to help their clients. That can be one of the biggest challenges for young designers. The ability to work with people is almost as important as the ability to create a visual design.

On a typical project, the graphic artist will meet with the client several times. The first meeting is usually a listening session—the client talks about the project and lists general requirements. ("We will print this in two colors," for example, or, "We'd like our annual report to let readers know about this company's concern for the environment.")

Then the graphic artist will work up two or three different ideas for the project. In a second meeting with the client, the graphic artist will present the ideas and ask the client to choose the one he or she prefers. Clients will typically review the project at least once more before it is printed or transmitted on the Internet.

## How Do I Get a Job and Advance?

If your high school has a graphic arts program, by all means take advantage of it. There may be other outlets for picking up skills, too—like helping design a literary magazine or working on the yearbook staff.

There are no requirements for formal training after high school. Because the field of graphic arts is so competitive, however, it's tough to get a job and earn a living without a college degree or training from an art school. In fact, the American Institute of Graphic Arts estimates that nine out of 10 people in the field have a college degree, and that most of those—80 percent—were graphic design or fine arts majors from a college, university or specialized art school.

Graphic artists need to assemble a "portfolio"—a collection of examples of their best work. It's the first thing a potential employer or client will ask to see. In a formal training program you'll learn how to assemble a portfolio to show off your strengths as a graphic artist. Internships also offer a chance to work on pieces to include in the portfolio.

At the start of your career, you'll probably work in an advertising agency or a graphics business. Or, you may find oportunities at magazines or newspapers. While holding a full-time job, many graphic artists start doing freelance work for their own clients. This is a good way to build up a client base if you want to start your own business.

Freelance work is often hard to come by, especially for young designers who are just starting out. Some jobs that used to be done by graphic artists—for example, simple newsletters—may now be done by people who have no formal training in graphic arts but know how to use computer software programs.

Graphic artists who stay with a large firm can be promoted to art director, design director or creative director of an art or design department. Others may start their own business and may specialize in a particular type of work—designing Web pages or company logos, for example.

## How Much Money Will I Make?

The average salary for entry-level graphic designers is between $23,000 and $27,000. Art directors, senior graphic designers and graphic artists who build their own successful businesses can earn much more. If you are self-employed, however—as many graphic artists are—you'll have to pay for your own health insurance.

## To Learn More

For a list of schools that offer degrees in graphic design, contact the American Institute of Graphic Arts, 164 Fifth Ave., New York, NY 10010.

For information on magazine art and design careers, contact the Society of Publication Designers, 60 E. 42nd St., Suite 721, New York, NY 10165.

### Did You Know?

Almost 60 percent of all graphic artists are self-employed. That's nearly seven times the average for other professions.

# Library Technicians

**Do you enjoy working with computers?**

**Are you precise and organized?**

**Do you like helping people find information?**

Your research paper is due next week. You head to the library to check out some books but discover that some of the books and magazines you need aren't on the shelves.

Luckily, a library technician is sitting at a nearby computer. Within minutes, he tells you the book you want is at a nearby library—and that he can place it on reserve. Next, he calls up the magazine articles and prints them out for you. Finally, he takes you to one of the library's computer terminals, shows you how to sign on to the Internet and helps you find several Web sites that are just what you needed.

## What's It All About?

We live in the information age. Knowing how to find the right information can be a challenge, however. That's always been the job of librarians, and as today's libraries increasingly become "media centers"—with computers, CD-ROMs and other technology—library technicians are playing a critical role in helping people get the information they need.

Library technicians help librarians acquire, prepare and organize material, and they assist users in finding materials and information. Library technicians are "paraprofessionals" because they work under the supervision of someone else—a librarian or library associate. Still, they may be the people who keep specific functions of a library operating on a day-to-day basis.

Duties of technicians vary. They may organize and maintain periodicals, prepare volumes for binding, handle interlibrary loan requests, prepare invoices, perform routine cataloging and coding of library materials, retrieve information from computer databases or supervise other support staff. In small libraries, technicians may handle a variety of responsibilities, but in larger libraries they usually specialize in such areas as personal computer applications, computer networking, computer repairs and maintenance, maintenance and operation of audiovisual equipment or multimedia materials production.

Library technicians often help people find the information they need. This may include answering questions by using reference tools such as almanacs, encyclopedias, dictionaries and periodical information. They also show library patrons how to operate the library's technologies, from CD-ROMs to the Internet to automated databases to new "virtual libraries."

As libraries become more computerized, technicians are handling more of the responsibilities that used to be assigned to librarians. Many libraries now use computers to offer self-service registration and track circulation, which has dramatically reduced the amount of time technicians used to spend manually recording and inputting records.

## Job Outlook

**A 28 percent** increase, to **100,000 jobs, by** 2006. The in**creasing automation** of libraries **has led to job growth** for library **technicians. Shrinking** budgets **can sometimes** increase employ**ment opportunities** for library **technicians,** as libraries try to **stretch their resources** by using **technicians to** do some of the **jobs formerly** performed by **librarians.**

Some technicians operate and maintain audiovisual equipment, including projectors, tape recorders and videocassette recorders. They may help library users with microfilm or microfiche readers. They also may design posters, bulletin boards and displays.

Technicians who work in school libraries encourage and teach students how to use the library and media center. They also help teachers find instructional materials that will help them make their lessons more interesting. They may help students with special assignments.

Some technicians work in special libraries—those maintained by a government agency, corporation, law firm, museum, medical center or research institution. They may conduct literature searches, compile bibliographies and prepare abstracts—usually on subjects that are of particular interest to the organization.

## What's It Really Like?

"There are some parts of my job that are just fascinating," says Diane, a library technician who works in the library of a trade association. "When I'm on the Internet looking up information or helping a library patron with an information request, the time just flies by."

Of course, not all days are like that. Technicians have some monotonous and repetitive job responsibilities. Preparing library materials before they go on the shelves is a fairly routine job, as is checking books in and out.

Still, for a person who enjoys learning new things, this is a great career. Nearly every day you'll have the opportunity to retrieve information from a variety of different sources. It's a constant education.

Helping people is one of the best parts of the job, technicians say. Technology can bring all the resources of the world's best libraries to a computer terminal in a school or public library. And library technicians are the ones with the skills and know-how to do it.

Technicians who work in school libraries work regular school hours. Those who work in public libraries or college and university libraries should expect more weekend, evening and holiday work. In specialized libraries, technicians usually work regular business hours, although they may occasionally have to work overtime.

## How Do I Get a Job and Advance?

Some people come to this field directly out of high school and learn on the job. More and more libraries, however, want people with a two- or four-year degree in library technology. These programs are offered by colleges and universities as well as community colleges.

Students in library technician programs learn about the library field and how it is changing. They gain a solid understanding of how libraries organize information. They learn about library and media organization and operation, and how to order, process, catalog, locate and circulate library materials.

Library technicians spend much of their time working at computers, so training programs devote a considerable amount of time teaching the many applications of a computer in a library. From ordering books online to controlling a library's inventory, today's library is highly automated. A knowledge of databases, library automation systems, online library systems, online public access systems and circulation systems is vital for library technicians. Many programs include supervised field work in addition to classroom study.

Technology brings changes to libraries every day. Libraries and associations offer continuing education courses to keep library technicians up to date on the newest developments in the field.

Once on the job, technicians usually advance by assuming added responsibilities. For example, technicians may start at the circulation desk checking books in and out. After gaining experience they may be assigned the responsibilities of storing and verifying information. They may even manage a department, branch or small library.

## How Much Money Will I Make?

Salaries vary, depending on where you work. A salary survey by *Library Mosaics* magazine found that technicians who work in two-year colleges average $27,200; in four-year colleges or universities, $30,200; in special libraries, $24,100; and in public libraries, $33,000.

## To Learn More

For information about a career as a library technician, contact the Council on Library/Media Technicians, P.O. Box 951, Oxon Hill, MD 20750 (http://library.ucr.edu/COLT). For information on training programs for library and media technicians, contact the American Library Association, Office for Library Personnel Resources, 50 E. Huron St., Chicago, IL 60611 (www.ala.org).

For information about job opportunities in school libraries in your state, contact your state's department of education. Your state library agency can provide information on job prospects for library technicians in your state.

### Did You Know?

**There are** an estimated **122,663 libraries** of all kinds **in the United** States today. **Most—nearly** 98,000—are **found in public** and private **schools. There** are about **8,900 public** libraries.

# Computer Technology

# Computer and Office Machine Repairers

**Do you like to figure out how things work?**

**Are you good with electronics?**

**Can you work by yourself without much supervision?**

*"The computer's down."*

In most offices, schools, factories, stores and restaurants, those dreaded words mean business is about to grind to a halt, if it hasn't already. Today, computers do everything from keeping track of how many hamburgers McDonald's sells, to controlling the production equipment on the Ford assembly line, to scheduling the airlines' flight departures. So when the computer isn't working, neither is most of the nation's workforce.

Computer and office machine repairers keep these vital machines up and running. As the number of computers continues to grow, so will opportunities in this rapidly expanding field.

## What's It All About?

Computer and office machine repairers install, maintain and repair computers and office equipment. They do preventive maintenance to keep the equipment up and running—and they figure out what's wrong and fix it when problems arise.

To excel in this job you must be able to lay out, build, test, troubleshoot, repair and modify the equipment on which you work. You must know how to interpret wiring diagrams so you can trace and connect wires. You should understand and be able to apply principles of electronics, electronic circuitry, engineering mathematics, electronic and electrical testing and physics.

Within this field, you can specialize. *Service technicians* are computer repair technicians who are usually employed by a computer equipment manufacturer. Some specialize in mainframe computers. Others work as microcomputer (PC) specialists. In either case, they are responsible for installing computers and other "peripherals," such as printers and drives; performing routine maintenance; and conducting "diagnostics"—figuring out what's wrong with a computer and how to fix it.

*Technical analysts* are computer maintenance and repair technicians who maintain computer equipment for an organization and its employees. They may work for hospitals, universities or large corporations, where the daily functioning of the organization involves heavy use of computers. They keep the computers up and running, install new software, troubleshoot problems and manage computer supplies.

*Office machine repairers* work on photocopiers, cash registers, mail processing equipment, fax machines and typewriters. They also may make cable or wiring connections when installing equipment, and work closely with electricians who do the wiring.

## What's It Really Like?

Were you the kid who took a clock apart to see how it worked? Did you

## Job Outlook

**The number** of jobs in the **field expected** to increase by 37 **percent, to** 194,000, by 2006.

drive your parents crazy asking "Why?" all the time? If so, computer and office machine repair may be the job for you.

When a machine first breaks down, you need to figure out what the problem is. Sometimes the answer is easy—a loose connection or a defective component, for example. More often, though, you'll have to do some investigating. You'll examine work orders to see what problems the equipment has had in the past. And you'll talk to the people who use the machines.

If that doesn't work, you'll need to use technology to find the answer. You may run special diagnostic software. You may use such tools of the trade as a voltmeter, an ohmmeter, a signal generator, an ammeter or an oscilloscope. More and more equipment has a self-diagnosing feature, which can make the repairer's job a little easier.

Still, finding the problem can be time consuming, so you need to be the kind of person who doesn't get frustrated if the first thing you try doesn't work. Figuring out what's wrong may take several hours—although fixing the problem may take only a few minutes. You may replace a defective component, circuit boards or wiring. You also may make adjustments to the equipment using small hand tools such as pliers, screwdrivers and soldering irons.

You need to know both hardware and software—especially system software. Problems in microcomputers are often caused by a glitch in the software rather than a defect in the hardware. As more and more computers are linked in local or wide area networks, you also must understand network technology.

Even though computer and office machine repairers work with machines, the job requires people skills along with technical knowledge. You're going to get phone calls from frantic people. Instead of "The dog ate my homework," they'll tell you "The computer ate my sales projections." You must be able to stay calm and know how to ask good questions and then listen for the answers.

And, of course, you'll need to interact with people when you show up to fix their equipment. "People don't expect computer repairers to walk in wearing a three-piece suit," says John, the director of information technology for a large public organization, "but they shouldn't have nose rings, either. Customers are trusting you with all the information on their computer, and they need to have confidence that you'll use good judgment." Before working in a bank or a securities office, you may need to be bonded. Before working on some specialized government computers, you may need security clearance.

As a computer or office machine repairer, you'll be able to get a job anywhere in the country, even in relatively small towns. But most repairers work in large towns and cities. About 60 percent of the people in this field are employed by wholesalers of computers or office equipment, or by firms that provide maintenance on this equipment for a fee. Others work for retail stores and some are hired by large organizations to keep their equipment up and running.

## How Do I Get a Job and Advance?

You need excellent math, science and computer skills to be successful in this field. Start in high school taking as many of these courses as you can. If you can, also take classes in electronics, engineering mathematics or engineering physics.

Many vocational schools and two-year community colleges offer programs in electronics. They will give you the training you need in digital electronics, devices, components, mathematics and network technology. You also can get the training you need in the military or on the job. If you want to be a computer technician, it's helpful to have an A+ certification awarded by the Computing Technology Industry Association (CompTIA).

Because this is a field where everything can change overnight, it's essential to stay up to date. Most computer and office machine repairers keep current by attending product training seminars conducted by manufacturers of the equipment they service.

As you get more experience, you can work as a troubleshooter, helping other repairers diagnose problems. You also may work with engineers to design equipment and develop maintenance procedures. Some repairers open their own repair shop or become wholesalers or retailers of the equipment they have learned so much about.

## How Much Money Will I Make?

The average salary for computer and office machine repairers is $32,000.

## To Learn More

For information on certification or careers, contact the Electronics Technicians Association, 602 N. Jackson, Greencastle, IN 46135; (765) 653-4301 (www.eta-sda.com/index.html). This site also has links to other electronics sites on the Web.

For information on A+ certification, contact the Computing Technology Industry Association (CompTIA), 450 E. 22nd St., Suite 230, Lombard, IL 060148-6158; (630) 268-1818 (www.comptia.org).

For additional information on a career as a computer repairer, consult the Computer Museum Network (www.tcm.org/resources/cmpcareers/cnc/comprepair.html).

### Did You Know?

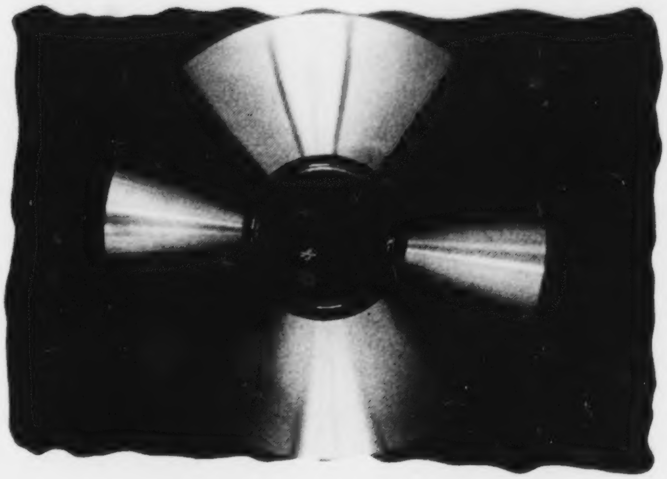
**Each year, more than 22 million computers are sold in the United States.**

# Computer Programmers

**Do you like solving problems?**

**Are you patient and persistent?**

**Do you work well under pressure?**



GIGO. In the computer world, that stands for "garbage in, garbage out." It's a reminder that a computer is only as good as the programmer who stands behind it.

People in this occupation tell computers what to do—which information to identify and access, how to process it and what equipment to use. As the number of computers in use continues to increase, job opportunities in this field will be plentiful.

## What's It All About?

Computer programmers write, test and maintain the detailed instructions—known as "programs" or "software"—that list, in logical order, the steps a computer must follow to perform properly. These instructions vary greatly, depending on the kind of information that needs to be accessed or generated. The program required to run the latest video game, for example, is quite different from the program that runs a bank's financial software. The program that duplicates conditions on an aircraft for pilot training in a flight simulator isn't anywhere near the same as the one that tells a computerized robot where to place the welds on a new car's chassis.

But computer programmers have written all those programs. They start by breaking down each step into a logical series of instructions the computer can follow. Then they code those instructions in a special computer language. Most programmers know several languages, from the basics like C and FORTRAN to advanced languages like Java, C++, Visual Basic and Ada. In fact, computer programmers are sometimes identified by the language they know or the environment in which they work—"He's an Internet programmer." "She's a C++ programmer."

Sometimes a programmer can write a simple program in a few hours or days. But many programs—especially those that draw data from many existing systems or involve complex graphics and other computing power—may take more than a year of work. On major projects, several computer programmers work together as a team under the supervision of a senior programmer.

Once the program is written, programmers need to test it to make sure the instructions are correct and it produces the desired information. If errors occur, they need to "debug" the program until it produces the right result.

There are two major types of computer programmers. *Applications programmers* are usually oriented toward business, engineering or science. They typically write software to handle a specific job within an organization, or they may adapt off-the-shelf software to meet a specific purpose. For example, they might revise a payroll program to conform it to the specific needs of a business.

## Job Outlook

A 23 percent increase, to 697,000 jobs, by 2006.

*Systems programmers* maintain and control the use of computer systems software. They make changes in the instructions that determine how the network, work stations and central processing unit of the system handle the various jobs they have been given. Because they are so knowledgeable about their computer system, these programmers also may help applications programmers determine the source of problems that occur within their program.

## What's It Really Like?

Programmers spend most of their day in front of a computer screen. Although they usually work about 40 hours a week, many sometimes log longer hours, especially when they're on a deadline. Because of telecommuting, a growing number of programmers are able to work at home at least part of the time.

"This is a job where you need to work well under pressure," says Sean, who started his own computer programming business while he was still in high school. "You rarely have the luxury of working on a program for a long time. Usually, people need it yesterday."

Programmers are employed in almost every industry. While firms that write and sell software are, naturally, among the largest employers, there also are programmers in businesses that provide engineering and management services. Manufacturers of computer and office equipment, financial and educational institutions, insurance carriers and government agencies employ programmers, as well.

A growing number of computer programmers work as independent consultants. This practice is helpful to employers—rather than hiring people, then laying them off when a big project is done, they just contract for the programming help they need when they need it. Some programmers prefer the life of an independent consultant, because they can work when they want to and take off when they want to. Given the shortage of trained programmers, they know there'll be a job waiting if they decide to go back into a regular job working for someone else.

The biggest potential health drawbacks are eyestrain, back discomfort and hand and wrist problems such as carpal tunnel syndrome. On the whole, however, computer programmers can expect to spend their working hours in a pleasant environment.

## How Do I Get a Job and Advance?

There are many paths available for programmers because employers' needs are so varied. But the general level of education required for computer programmers is rising. While some programmers can get jobs with a two-year degree or certificate, the majority—about 60 percent—had a four-year college degree or higher in 1996. Some of those individuals had a degree in computer science, mathematics or information systems, but others had taken special courses in computer programming to supplement their study in such fields as accounting and business.

Today, it's especially important for programmers to know the more-advanced computer languages. These include Java, C++, Visual C++, Ada and graphical interface or systems programming. They also should know about different types of hardware and be able to work with such database systems as DB2, Oracle and Sybase. But because technology changes so rapidly in this field, you should expect to update your skills regularly. Otherwise, you'll find the market has passed you by.

In addition to knowledge of programming languages, employers are looking for people with the right attitude to be a programmer. This isn't a job where you can find the answers in the back of the book—you need to have both ingenuity and imagination. Since many programmers work in teams, it's also important to be able to get along with other people and to communicate with nontechnical people.

Employers also look for people with experience. While you're taking your training, you should try to get some practical work experience, either through a part-time job or an internship. Courses in business, accounting, engineering and science will make you more marketable.

Job advancement opportunities are excellent for programmers who keep up with the latest technology. In a large company, they may be promoted to lead programmer. Applications programmers may move into systems programming.

Certification is becoming increasingly important as a way of demonstrating that programmers have the skills employers need and want. Organizations such as the Institute for Certification of Computing Professionals sponsor programs.

## How Much Money Will I Make?

Average earnings for computer programmers are about $40,100 a year. But those with a four-year degree in computer programming can expect to earn a starting salary of $35,100 and move up from there.

## To Learn More

For information on certification as a computing professional, contact the Institute for Certification of Computing Professionals, 2200 E. Devon Ave., Suite 268, Des Plaines, IL 60018 (www.iccp.org).

For more on computer careers, contact the Association for Computing, 1515 Broadway, New York, NY 10036 (www.acm.org).

### Did You Know?

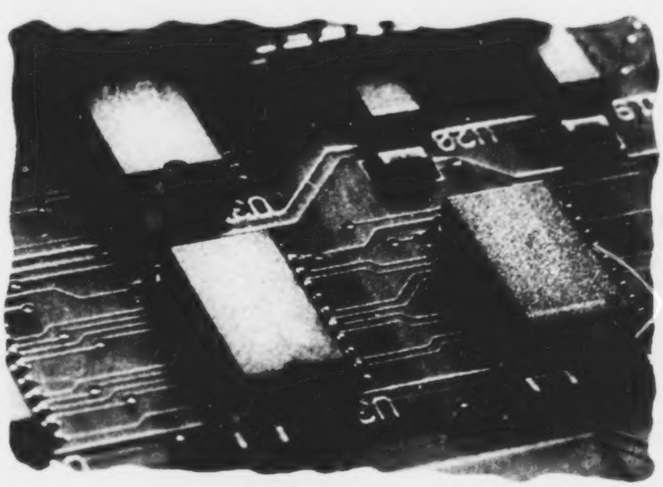
**In his book *The Road Ahead*, Bill Gates tells a story of why computer programming is a useful skill. While in high school, he wrote the program that set students' schedules. "I surreptitiously added a few instructions and found myself nearly the only guy in a class full of girls," Gates notes.**

# Computer Scientists, Computer Engineers & Systems Analysts

**Do you like to solve complex problems?**

**Do you have superior communication skills?**

**Are you logical and analytical?**



If you want a description of a typical day in this field, one computer engineer commented, "There isn't any typical day." In fact, adapting to the unexpected and figuring out how to design (and solve problems with) computer systems and software is one of the biggest challenges facing computer scientists, engineers and systems analysts.

But with the explosion of computers in the workplace, there is a constant need for people to design and develop hardware and software systems and to incorporate technological advances into new or existing systems. There are tremendous opportunities in these high-paying jobs.

## What's It All About?

The computer industry is so new that even its job titles are still evolving. But the professionals within this industry are generally divided into three main classifications.

*Computer scientists* have the highest level of theoretical expertise and innovation. They may work as theorists, researchers or inventors. In private industry, they apply computer theory; develop specialized languages or information technology; or design programming tools, knowledge-based systems or even computer games. In academic institutions, they work on projects ranging from developing and advancing the uses of virtual reality to robotics.

*Computer engineers* apply the theories and principles of science and mathematics to the design of hardware, software, networks and processes to solve technical problems. They coordinate the construction, maintenance and future growth of a company's computer systems. They work with all departments, discovering each one's computer needs, then suggesting what technical direction the company should proceed in. Computer engineers often work as part of a team that designs new computing devices or computer-related equipment, systems and software.

*Systems analysts* figure out how computer technology can be adapted to meet the individual needs of an organization. They develop systems for obtaining, processing and presenting information in the form required for the operation of organizations such as business firms or government departments.

Typically, systems analysts are called in when a problem arises with computer technology. First, analysts need to clearly define the goals of the system: What is it, exactly, that the computer system should do? That involves getting in-depth knowledge of how a particular department operates—and that can require a lot of time listening. "It usually takes several meetings before people tell you all the things they want to do," one systems analyst said.

Sometimes systems analysts design a new system, including both hardware

## Job Outlook

Computer science, computer engineering and systems analysis are expected to be the three fastest-growing occupations in the United States through the year 2000, according to the U.S. Department of Labor. The number of jobs is expected to increase by 107 percent, to 1,937,000, by 2006.

and software. They also may install and adapt a new software package that will improve productivity.

As more and more computers are networked so they can share information, more professionals will be needed to set up and service these networks. Falling prices of computer hardware and software will encourage businesses to invest in computerized operations. But most will need the skill and expertise of computer professionals to get the most from their investment.

## What's It Really Like?

Most people are aware of the technical skills needed to be successful in this field, but computer scientists, engineers and systems analysts need good people skills as well. Flexibility, strong interpersonal skills and a friendly disposition are highly valued traits in this industry. So is the ability to listen, to communicate with others who may not have a technical background and to work with others as part of a team.

Creativity is a requirement for systems analysts. Typically, they must figure out how to work with old or misapplied systems and limited budgets. Sometimes that means trying to figure out the difference between what people want and what they need in their system.

Professionals in this field need to be able to do several things at once. They often are called on to deal with a number of tasks simultaneously, so they need the ability to concentrate and pay close attention to detail.

It's a fast-paced occupation. In theory, computer professionals work a 40-hour week, but most put in long hours to meet deadlines and solve specific problems. However, a growing number of people in this field telecommute for at least part of their work week, communicating by e-mail and the Internet.

## How Do I Get a Job and Advance?

There is no single route into this career. But a bachelor's degree is required by nearly all employers. Computer hardware engineers need a degree in computer engineering or electrical engineering, while software engineers are more likely to need a degree in computer science. Systems analysts should have a bachelor's degree in computer science, information science, computer information systems or data processing.

Some people start out in other professions where they develop advanced computer skills. For example, an accountant may become a systems analyst or a computer support specialist who specializes in accounting systems development.

Employers look for people who are familiar with programming languages and have broad knowledge of, and experience with, computer systems and technologies. Courses in computer programming or systems design offer good preparation. Since employers generally look for experience, entry-level employees can make themselves more employable by participating in internships or co-op programs while they are in school.

Of course, technology changes so rapidly that continuing education is necessary. In fact, many of the people in the profession say the opportunity to keep learning is one of the best parts of the job. As a result, certification is becoming more common in the industry. The Institute for Certification of Computing Professionals conducts one certification program. Applicants must pass written exams covering both their general knowledge of computers and their specialized knowledge of a particular field.

Systems analysts may be promoted to senior or lead systems analysts. They also may move into management positions, such as manager of information systems or chief information officer. Computer engineers and scientists in industry may eventually advance into management or project leadership positions. In academic institutions, advancement is generally to department head and often involves research or publishing. Computer professionals with several years of experience may start their own computer consulting firms.

## How Much Money Will I Make?

Median annual earnings of computer systems analysts and scientists who work full time are nearly $50,000. The top 10 percent in salary earn more than $75,000.

## To Learn More

For information on careers in the computing industry, contact the Association for Computing, 1515 Broadway, New York, NY 10036 (www.acm.org); or IEEE Computer Society, Headquarters Office, 1730 Massachusetts Ave. NW, Washington, DC 20036 (www.computer.org).

For information about the designation Certified Computing Professional, contact the Institute for Certification of Computing Professionals, 2200 East Devon Ave., Suite 268, Des Plaines, IL 60018 (www.iccp.org).

### Did You Know?

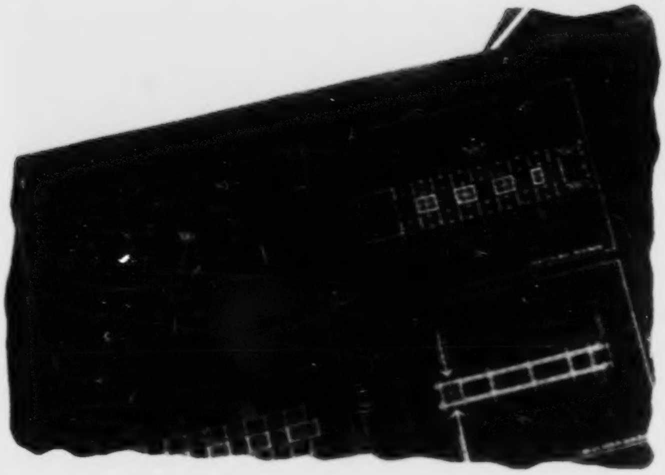
**More than 30 percent** of **systems analysts did** not **intend to do that** job full **time. Especially** in smaller **companies, employees with good** technical skills **often evolve into** becom**ing the** systems analyst.

# Drafters

**Do you have a talent for drawing—particularly three-dimensional objects?**

**Do you work well with others?**

**Do you pay close attention to detail?**



What do the space shuttle, the Verrazano Narrows Bridge and St. Paul's Cathedral have in common? All were produced from technical drawings created by drafters.

Since the 15th century, drafters have been preparing technical drawings and plans that have been used to build everything from bridges to office buildings to pipelines. The same is true today, although the modern drafter has an array of computer technologies at his disposal.

## What's It All About?

A drafter creates a drawing that indicates the exact size and shape of an object. These drawings show as many views of an object as may be necessary to define its exact shape and size. The most common method, called orthographic projection, gives the exact shape and size of an object from three views: top, front and side.

Drafters' drawings show the technical details of products and structures. They specify dimensions, materials to be used and the procedures and processes to be followed. Drafters fill in technical details based on drawings, rough sketches, specifications, codes and calculations previously made by engineers, surveyors, architects and scientists.

Because drafters need to understand the precise details of the objects they are drawing, they generally specialize in a particular area. For example, drafters may draw on knowledge of standardized building techniques to draw in the details of a structure.

*Architectural drafters* draw the architectural and structural features of buildings and other structures. Some do only commercial buildings, others only residential. Some specialize in a particular building material, such as reinforced concrete, masonry or steel.

*Civil drafters* prepare drawings and topographical and relief maps. These are used in major civil engineering projects including highways, bridges, flood-control projects and water and sewage systems.

*Electrical drafters* prepare wiring and layout diagrams. These are used by workers who erect, install and repair electrical equipment and wiring in buildings, power plants, communication centers and electrical distribution systems.

*Electronic drafters* draw the wiring and circuit board assembly diagrams, schematics and layout drawings used to manufacture, install and repair electronic devices and components.

Other areas of specialization include *aeronautical drafting*, *mechanical drafting* and *process piping* or *pipeline drafting*.

## Job Outlook

**The number** of jobs is expected **to hold** steady at about **310,000 through** 2006. Opportunities will be brightest for **those with** at least two years **training** in a technically strong **drafting** program and some **expertise** in CAD.

## What's It Really Like?

Until very recently, drafters sat at drawing boards and used compasses, dividers, protractors, triangles and other devices to prepare drawings manually. There still is a need for manual drafting skills, but often only in specialty firms that produce one-of-a-kind drawings with little repetition.

Today, most drafters sit at computer screens and use computer-aided drafting (CAD) systems to prepare their drawings. Once a drawing is created, it is stored electronically so that revisions or duplications can easily be made.

The computer has increased the complexity of the job, but it also has made drafters more productive. "I can create a 3-D drawing and take a client inside a structure," one drafter says. The computer also makes it easier to make revisions and to prepare several variations of a particular drawing.

Of course, all that time spent in front of a computer terminal can lead to eyestrain, back discomfort and hand and wrist problems. Those are the primary occupational hazards.

About one-third of drafters work for engineering or architectural services firms. Another third work in durable goods manufacturing—for example, machinery, electrical equipment and fabricated metals. Most of the rest work in the construction, communications and utilities industries. One growing trend is for drafters to work for temporary personnel agencies on a contract basis.

Depending on their area of specialization, drafters may be subject to layoffs during economic downturns. Engineering and architectural services, for example, are industries that are highly sensitive to cyclical changes in the economy.

## How Do I Get a Job and Advance?

Most employers prefer to hire people who have completed post-high school training in drafting. Vocational-technical schools, junior and community colleges and technical institutes offer this specialized training. Employers want applicants who have well-developed drafting and mechanical drawing skills; knowledge of standards, mathematics, science and engineering technology; and a solid background in CAD. Four-year colleges and universities usually do not offer drafting but may offer courses in engineering, architecture and mathematics that are helpful.

While you're still in high school, take courses in math, science, computer technology, drafting, design and computer graphics. You need excellent drawing skills, as well as accuracy and neatness. Drafters also need good interpersonal skills because they work closely with engineers, surveyors, architects and other professionals.

A word of caution: Not all drafting programs emphasize the skills employers value most. Before choosing a program, talk with several prospective employers to find out what skills you'll need on the job. Ask any school to provide you with the names of recent graduates, and ask questions about the kind of equipment and the quality of the faculty.

The American Design Drafting Association has established a voluntary certification program for drafters. Certification involves a written examination and demonstration that a candidate understands basic drafting concepts such as geometric construction, working drawings and architectural terms and standards. Certification is less widespread in this occupation than in some others.

Entry-level drafters usually do routine work under close supervision. They advance to more difficult jobs performed under less supervision. Eventually, drafters may advance to senior drafter, designer or supervisor.

Drafters also may advance by continuing their education and moving into a related field. Some become engineering technicians, engineers or architects.

## How Much Money Will I Make?

The average salary for drafters is about $31,250. The most experienced drafters earn about $41,000 on average.

## To Learn More

For general information on drafting as a career, contact the American Design Drafting Association, PO Box 799, Rockville, MD 20848 (www.adda.org)

### Did You Know?

**Leonardo da Vinci invented many of the mechanical drawing techniques that are still in practice today. More than 4,200 of his drawings survive.**

# Construction

# Construction and Building Inspectors

**Do you like the feeling of knowing you've made things safer for other people?**

**Do you want a job that takes you out of the office?**

**Are you a person who believes in playing by the rules?**

The contractor wasn't honest, but the homeowner didn't know that. The contractor had installed substandard materials in the family's kitchen addition—including an inexpensive water pipe that was likely to leak and cause major damage within a few years.

Luckily, the building inspector caught the problem. He made the contractor replace the defective pipe before he would grant the certificate of occupancy.

It's not every day that a building inspector finds a problem on a construction job. Fortunately, however, the health and safety of the public are protected by inspectors who make sure building codes and zoning regulations are enforced.

## What's It All About?

You can't walk down the street or drive very far in most communities without seeing signs of construction: a home addition, a new elementary school, a repair to a bridge. Each of these types of construction is governed by building codes that make sure the public's health and safety are protected. Construction and building inspectors visit construction sites to make sure the laws are followed.

There are many different types of construction and building inspectors. *Plan inspectors* do their work before construction begins. They review plans for a building to make sure they meet building code requirements. They also decide whether the plans fit the site's engineering and environmental requirements.

*Building inspectors* ensure the general safety and structural quality of buildings as they are under construction. Before the concrete is poured for a building's foundation, the inspector visits the site to examine soil conditions and look at the positioning and depth of the footings. The inspector returns to the site after the foundation has been completed.

Building inspectors also are responsible for making sure buildings meet fire safety codes. They inspect fire sprinklers, alarms and smoke-control systems. They ensure that the building has enough fire doors and exits.

*Electrical inspectors* check the wiring and electrical systems to make sure they work and meet all electrical codes. They also make sure the wiring is installed correctly on heating and air conditioning systems and appliances.

*Home inspectors* usually conduct inspections of homes when they are sold. Many home buyers hire a home inspector to inspect a house before they purchase it. New homes also must be thoroughly inspected before the first buyers can move in. Home inspectors look at all the systems in a typical home, from the plumbing, to the heating system, to the roof, to the electrical wiring.

## Job Outlook

A 14.5 percent increase, to 76,000 jobs, by 2006. A growing concern for public safety and improvements in the quality of construction should continue to create demand for construction and building inspectors.

*Public works inspectors* are responsible for examining government-funded construction projects, including roads, bridges and dams. They often specialize in a particular type of construction— for example, highways or bridges.

Sometimes inspectors are asked to investigate construction that may have been done without proper permits. Some unscrupulous contractors may offer to do work without a building permit. This may save a few dollars up front but it can lead to real problems later. If the work is later found not to meet the building code, for example, it may need to be done again—at the building owner's expense.

## What's It Really Like?

This isn't an office job. Building inspectors go to job sites and see for themselves whether the work is being done correctly. Much of the inspection is visual, but inspectors may use surveying instruments, tape measures, metering devices and testing equipment such as concrete strength measurers. They often take photographs. They keep logs of their work, file reports and, if necessary, act on their findings.

Computers are a vital aid to construction and building inspectors, who may use the computer to check details about the building, the occupancy permit or other aspects of the job. Inspectors also may record their findings on their laptop computer so they can generate reports when they return to their office.

Though it can be very satisfying seeing to it that safety conditions are met and consumers aren't shortchanged, being an inspector is also tough and demanding work. Inspection sites are often dirty and may be cluttered with tools or debris. An inspector may have to climb a ladder or crawl around in tight spaces. Although the work isn't generally hazardous, inspectors do wear hard hats when they're on a job site.

Inspectors usually work alone. But on a large or complex project, a team of inspectors may work together—especially since most inspectors have an area of specialization.

When inspectors find a code violation or something that doesn't comply with the specifications in the contract, they are responsible for notifying the construction contractor, superintendent or supervisor. If the problem is not corrected within a reasonable time, a building inspector who works for a state or city government has the authority to issue a "stop-work" order, halting the project.

## How Do I Get a Job and Advance?

Typically this is a job you move into. Construction and building inspectors must have a thorough knowledge of construction materials and practices. Either they know a great deal about a type of construction, such as structural or heavy construction, or they know about a specific area, such as plumbing or electrical work. Most construction and building inspectors log several years as a manager, supervisor or craft worker before they become an inspector, and many have held jobs as carpenters, electricians, plumbers or pipefitters.

Construction and building inspectors need a mix of technical knowledge, experience and education. In addition to practical job experience, you should expect to receive some formal training—for example, in engineering or architecture. Community and junior colleges also offer certificate or associate degree programs in building inspection technology. You'll study construction technology, drafting, math, building inspection and blueprint reading.

Once on the job, your education will continue. Construction and building inspectors need to learn building codes and standards. You may start out working with a senior building inspector who will be responsible for teaching you about inspection techniques; codes, ordinances and regulations; contract specifications; record keeping and reporting. Then you'll be given the responsibility of inspecting less-complex types of construction— a kitchen addition to a home, for example. As you gain experience, you'll be given more responsibility.

Most states and cities require inspectors to pass a certification exam. These stringent and comprehensive tests include questions on building code requirements, construction techniques and materials.

Even after you're hired, you should expect to continue your education. The construction industry is ever changing, and inspectors need to keep up with the latest information about technical developments and changes in construction practices, as well as any revisions to state and local building codes.

## How Much Money Will I Make?

The average salary for construction and building inspectors is about $33,700. Salaries in large cities are substantially higher than those in smaller communities.

## To Learn More

For information on a career as a home inspector, contact the American Society of Home Inspectors, 85 W. Algonquin Road, Arlington Heights, IL 60005 (www.ashi.com).

For information on certification and a career as a construction or building instructor, contact the International Conference of Building Officials, 5360 Workman Mill Road, Whittier, CA 90601 (www.icbo.org); or the Building Officials and Code Administrators International, 4051 W. Flossmoor Road, Country Club Hills, IL 60478 (www.bocai.org).

### Did You Know?

**More than half of all construction and building inspectors work for local governments.**

# Construction Managers

**Do you want a job that combines business, architecture and engineering?**

**Are you decisive?**

**Do you work well with many different types of people?**

A supplier has just arrived with a load of piping and needs to know where to put it. The crane operator is on the phone saying he's been held up on a job and can't be there tomorrow. Will Thursday be OK? Your electrical subcontractor needs a check so he can pay one of his suppliers. And the client wants to stop by to see how work is progressing.

Juggling all these responsibilities is the construction manager. If you're a person who likes challenges, wants to work in construction and is able to do several things at once, this good-paying job could be for you.

## What's It All About?

"Do you want a job where every day is predictable? Then don't go into construction management," advises George, a manager with a large construction firm. "You have to be able to keep lots of balls in the air, and you always, always need to be ready to act quickly when a problem arises—which it does about five times a day."

Construction managers are the people who plan and direct construction projects. Typically, they schedule and coordinate all the design and construction processes including the selection, hiring and oversight of specialty subcontractors.

It's a complex job that requires excellent people skills as well as a good knowledge of the construction industry. From coordinating and managing people, materials and equipment to making sure the job is completed on time and under budget, the construction manager has big responsibilities.

Construction managers are responsible for making sure the materials, tools and equipment needed to do the job are delivered on time. They may need to obtain permits and licenses so construction can move forward. They track and control construction costs to avoid cost overruns. On the job, they keep an eye on the quality of construction, worker productivity and safety.

Construction managers regularly review engineering and architectural drawings and specifications, both to monitor progress and to make sure the plans and "specs," as they are known, are being followed exactly. They may prepare daily reports of progress and requirements for labor, material, machinery and equipment at the construction site. They meet regularly with owners, subcontractors, architects and others involved in the design of the building to monitor and coordinate all phases of the construction project.

There are other people who are responsible for part of the work of a construction manager—for example, cost estimators or project engineers. In the construction industry, these people are often called "constructors." The term "construction manager" is reserved for

## Job Outlook

An 18 percent increase to 294,000 jobs by 2006.

the professional who manages, supervises and coordinates the construction process from conceptual development through final construction—and does it in a timely and affordable way.

## What's It Really Like?

Construction managers spend part of their time in an office and part of their time at the job site. They may work out of a central office or have a field office at the construction site.

Managers need to be adaptable and able to work in a fast-paced environment. When a construction worker has a problem and construction is held up, the manager needs to decide quickly how to solve the problem.

Seldom does one firm do all the work on a particular job. Instead, the general contractor, who has overall responsibility for the job, will subcontract out certain responsibilities—electrical work, plumbing or excavation, for example. Most construction managers work for a general contractor. Managers are responsible for dealing with subcontractors to make sure they complete their work on time.

Managers need to be logical thinkers. Often in construction, the work of one set of subcontractors can't start until another group of workers finishes their job. The people who install electrical wiring, for example, can't start work until the roof is up and the walls are in place. The construction manager needs to be able to fit all the pieces of the puzzle together—breaking the construction site activities into logical steps, budgeting the time required to meet the deadlines and adjusting as necessary when things don't go as planned.

Large jobs like constructing an office building or an industrial complex are too difficult for a single individual to manage. Typically these jobs are divided into smaller segments: site preparation, including clearing the land and earth moving; sewage systems; landscaping and road construction; building construction, including excavation and laying the foundation; building the structural framework, floors, walls and roof; and building systems, including plumbing, electrical, and heating, ventilating and air conditioning.

There are companies that specialize in construction management. Some construction managers work for engineering, architectural and surveying firms or for local governments, real estate developers or educational institutions.

Stress levels are high in this job (in one survey, 60 percent of construction managers mentioned stress as a definite negative about their profession). But rewards are high, too. Construction managers enjoy getting to know a wide variety of people—from architects, to construction workers, to contractors, to buyers—and seeing jobs through to completion.

## How Do I Get a Job and Advance?

Construction managers need a solid background in building science, business and management. They need to understand contracts, plans and specifications. They need to know about construction methods, materials and regulations. But most of all, managers say, "practical experience" is the key to success in this field. Construction managers have such wide responsibilities that they need a wide variety of skills and knowledge, including plumbing, basic electrician training, standard construction techniques, blueprint reading, budgeting and purchasing. Any high school courses that will familiarize you with any of those skills will be a plus.

In the past, people came to construction management from the construction crafts—carpentry, masonry, plumbing and electrical work. But today, more and more employers—especially the large construction firms that employ most construction managers—want people who combine real-world experience with at least a bachelor's degree in construction, building science or construction management.

More than 100 colleges and universities offer four-year degree programs in construction management and construction science. Students learn about project control and development, site planning, cost estimating and scheduling. They learn business skills—accounting, business and financial management, contract administration. They learn the basics about construction materials and value analysis (a cost-management technique). They also study engineering, architectural science, mathematics, statistics and information technology.

Certification is not required, but there are voluntary certification programs available. Many employers prefer to hire managers who are certified.

First jobs are often as assistants to project managers, field engineers, schedulers or cost estimators. As construction managers gain experience, they may become managers of small projects and then eventually supervise a major construction project.

Within large companies, managers may eventually become top-level managers or executives. Some go into business as independent consultants. Others establish their own construction management business or general contracting firm.

## How Much Money Will I Make?

Salaries vary widely. Starting salaries are in the $28,000 to $30,000 range, but experienced construction managers may earn as much as $100,000. In addition to their salary, many construction managers receive bonuses and use of a company vehicle.

## To Learn More

For information about career opportunities in the construction industry, contact Associated Builders and Contractors, 1300 N. 17th St., Arlington, VA 22209 (www.abc.org); or Associated General Contractors of America, 1957 E St. NW, Washington, DC 20006 (www.-agc.org). For information about construction management and construction manager certification, contact the Construction Management Association of America, 7918 Jones Branch Drive, Suite 540, McLean, VA 22102 (www.-access.digex.net/~cmaa).

### Did You Know?

One growing area within the construction industry is stadium construction. In the 1990s more than $[illegible] billion has been spent on 35 completed stadium projects. Another 21 projects, costing an estimated $4 billion, are under construction.

# Electricians

**Are you safety conscious?**

**Do you work well on your own?**

**Do you have good color vision?**

HIGH VOLTAGE
DANGER

The sound of the clock radio wakes you up. You flip on the light over the sink to brush your teeth. You click on the cable TV to see what the weather will be on the West Coast, or in Chicago. You open the refrigerator to grab a cold glass of orange juice.

Without the work of electricians, you'd probably have a hard time even getting out of bed in the morning. And when you think of all the things that run on electricity, you know that our economy would grind to a halt without the work of the people who install our electrical system and keep it up and running.

## What's It All About?

We live in a wired world. Electricity is essential for light, power, air conditioning and refrigeration. Electricians install, connect, test and maintain the electrical systems that provide everything from climate control to security to communications. They also may install and maintain the electronic controls for machines in business and industry.

Many electricians—more than half—work in the construction industry. They are responsible for installing the wiring or cable in the building before it is occupied. Some electricians specialize in residential work. They do everything from rewiring a home, to replacing an old fuse box, to installing a separate electrical line for a microwave oven.

Other electricians work in large factories. They may repair motors, transformers, generators and electronic controllers on machine tools and industrial robots. Electricians who work in large office buildings and small plants may repair all types of electrical equipment. Maintenance electricians inspect equipment in order to locate and correct problems before breakdowns occur.

In addition to installing the electrical wiring in a building, electricians also may install the fiber optic or coaxial cable for computers, cable televisions and other telecommunications equipment. As the number of computers continues to increase, there will be added demand for electricians—both to install wiring in new buildings during construction and to retrofit older homes and businesses for the information age.

## What's It Really Like?

In the case of new construction, electricians first look at blueprints to check the location of circuits, outlets, load centers, panel boards and other electrical equipment. They place conduit (pipe or wiring) into the walls, partitions or other concealed areas. They also fasten to the wall the small metal (or plastic) boxes that will house the electrical switches and outlets. Then they pull insulated wires or cables through the conduit to complete the electrical circuits.

## Job Outlook

A 9 percent increase, to 627,000, jobs by 2006. Job opportunities vary by geographic area. Because of the length of training required and the relatively high wages, a smaller proportion of electricians leave their occupation each year than do other craft workers.

Once the wire is in place, electricians connect it to circuit breakers, transformers or other components. They join wires by twisting the ends together with pliers, then covering the connections with special plastic connectors. If a stronger connection is necessary, the electrician may use an electric soldering gun to melt metal onto the twisted wires, which he or she then covers with a special electrical tape.

In doing all this work, electricians are responsible for following the National Electric Code and state and local building codes. When the wiring is finished, they test the circuits for proper connections.

Once systems are installed they may break down. In that event, electricians are called in again. They must identify the source of the problem and figure out how to correct it. They work with a variety of hand tools—screwdrivers, pliers, knives, hacksaws. They also may use testing equipment—oscilloscopes, ammeters and test lamps.

Being an electrician is often strenuous work. Electrical workers can be seen working in all types of conditions: dirty, dusty, hot, wet, cold, confined spaces, in ditches or other uncomfortable places. They frequently work on ladders or scaffolds. And they run the constant risk of electrical shock if they do not follow safety precautions. Most electricians work a standard 40-hour week. Those who do maintenance work may need to work nights or weekends. Those who work for a company specializing in residential repairs may be on call some weekends.

Electricians who work primarily in the construction industry may be laid off during economic slowdowns. They also may have to travel relatively long distances—up to 100 miles—to get to a job site. On the other hand, electricians who know how to install or retrofit buildings with fiber optic or coaxial cable should have excellent job prospects as the telecommunications revolution increases the number of computers.

## How Do I Get a Job and Advance?

Many people learn this trade by completing an apprenticeship. Typically, you must be at least 18 and a high school graduate to enter an apprenticeship program, which generally lasts four to five years and includes both classroom instruction and on-the-job training. Apprenticeship programs are often sponsored by joint training committees made up of local unions of the International Brotherhood of Electrical Workers and local chapters of the National Electrical Contractors Association.

As an apprentice, you'll study blueprint reading, electrical theory, electronics, mathematics, electrical code requirements and safety and first aid practices. You'll also get special training in welding and communications and fire alarm systems. On the job, you'll work under the supervision of an experienced electrician. At first you may drill holes, set anchors and set up conduit. Later you'll measure, fabricate and install conduit, as well as install, connect and test wiring, outlets and switches. You'll also learn how to set up and draw diagrams for entire electrical systems.

If you don't enter a formal apprenticeship program, you may be able to find work as an electrician's helper. But you may need to take a correspondence course or attend a trade school to supplement what you're learning on the job.

In high school, take as many classes as you can in mathematics, electricity, electronics, mechanical drawing, science and industrial technology. You should be in good health and have at least average physical strength. You also need good color vision because you will have to identify electrical wires by color.

In most places you'll need to be licensed as an electrician. This usually involves passing an exam that tests your knowledge of electrical theory, the National Electrical Code and local electric and building codes.

Electricians may advance to become supervisors or superintendents. Some may open their own business as an electrical contractor, although this may require a special license as well as the money to cover start-up costs.

## How Much Money Will I Make?

The average wage for electricians is $32,200. The top 10 percent in salary earn approximately $53,000. Apprentices usually earn between one-third and one-half of the wage paid to experienced electricians.

## To Learn More

For more information about the work of electricians, contact Independent Electrical Contractors, 507 Wythe St., Alexandria, VA 22314; (703) 549-7351 (www.ieci.org); or the International Brotherhood of Electricians, 1125 15th St. NW, Washington, DC 20005 (www.ibew.org).

For information on becoming an electrical contractor, contact the National Electrical Contractors Association, 3 Metro Center, Suite 1100, Bethesda, MD 20814 (www.necanet.org).

### Did You Know?

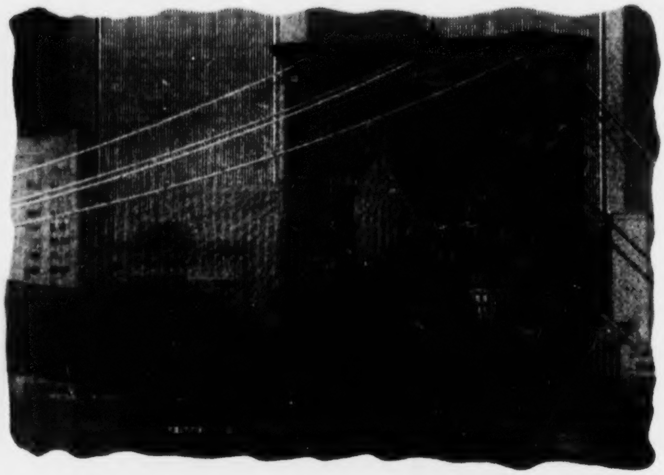
**In 1950, the United States used about 329 billion kilowatt hours of electricity. By 1995 the number had skyrocketed to 2.9 trillion kilowatt hours.**

# Engineering Technicians in Con

**Do you like working outdoors?**

**Can you do accurate, detailed work?**

**Can you work as part of a team?**



The bridge would carry thousands of commuters across the river and into the city every day. But before the company could submit a bid of how much it would cost to build it, the company needed to know the exact conditions at the job site.

A team of civil engineers and engineering technicians went to inspect. They tested the soil. They made accurate measurements of the length of the span. Their calculations told the company exactly which types of materials it should use and approximately how long it would take to get the job done. Thanks to their accuracy, the construction company won the multimillion-dollar bid and got the job.

If you are interested in solving problems like these, but you don't want to get a four-year engineering degree, you might consider a career as an engineering technician. In the construction industry, there is always a need for people with the practical, hands-on skills that engineering technicians possess.

## What's It All About?

The majority of construction-related engineering technician jobs are in civil engineering. Civil engineers design and supervise the construction of roads, railroads, bridges, wastewater treatment systems, dams and buildings. Civil engineering technicians work with them, using the principles and theories of science, engineering and mathematics to solve technical problems. Their work is more limited, and generally more practically oriented, than the work of scientists or engineers.

Civil engineering technicians provide technical support to civil engineers, civil engineering technologists and civil engineering associates in the research, design, construction, operation and maintenance of major construction projects. They also may perform the surveys and studies that are needed in those types of construction. They inspect water and wastewater treatment systems to make sure pollution control requirements are met.

Some civil engineering technicians estimate construction costs and specify material to be used. Others may even prepare drawings or perform land surveying duties.

Civil engineering technicians may specialize as civil engineering detail drafters, technical assistants or laboratory technicians.

## What's It Really Like?

This is a hands-on job. You should expect to spend a significant part of your time outdoors on job sites. As with other construction jobs, you may not work on some days because of bad weather and then work overtime to finish the job on time.

Usually engineering technicians are

### Job Outloo

**An** 11.6 percent increase, to **13,390** jobs, by 2006.

part of a team. They need good communication skills and the ability to work well with others.

The rewards of the job come from solving complicated problems. However, engineering technicians may be exposed to hazards from equipment or toxic materials.

## How Do I Get a Job and Advance?

It is still possible to get some engineering technician jobs without formal training. But employers prefer people with at least a two-year degree in engineering technology. You can take these courses at technical institutes, junior and community colleges, public and private vocational-technical schools, and through some technical training programs in the armed forces. If you've taken college-level courses in engineering, science or mathematics, you may qualify for some positions, although you'll probably still need additional specialized training and experience.

The armed forces offer training in some of the technical aspects of this job. The skills acquired in military programs are often narrowly focused, however, and do not always transfer to civilian industry, which requires broader training. You may need additional training after your military service.

Look carefully at any school before you choose to enroll. Many schools say they offer engineering technician training programs, but the quality of these programs varies considerably. You can feel confident if the program has been accredited by the Accreditation Board for Engineering and Technology (ABET).

Another word of caution: Some community colleges offer a two-year pre-engineering program. While those programs often do a good job of preparing students to enroll in a four-year college engineering program, they may not be the best preparation for a job as an engineering technician. The courses that do the best job of preparing students for jobs as engineering technicians are those that stress hands-on applications rather than engineering theory. On the other hand, some of the courses required for a certificate as an engineering technician would not count toward a four-year engineering degree. So you don't waste your time or money, it's helpful to have a clear idea about your ultimate career goal—whether it's being an engineer or an engineering technician—before you enroll.

If you're planning to concentrate on environmental engineering technology, you should take some classes in environmental regulations and in the safe handling of hazardous materials. Computer skills, including computer-aided design, are also helpful.

Once hired, you'll probably start by handling routine duties under the close supervision of an experienced technologist or an engineer. As you gain experience, you'll be given more responsibility and more challenging assignments.

## How Much Money Will I Make?

Starting salaries for engineering technicians begin at about $20,000. People in the most senior-level positions can earn about $55,000.

## To Learn More

Information on engineering technology programs that have been accredited by ABET is available from the organization at 111 Market Place, Suite 1050, Baltimore, MD 21202 (www.abet.ba-md.us).

### Did You Know?

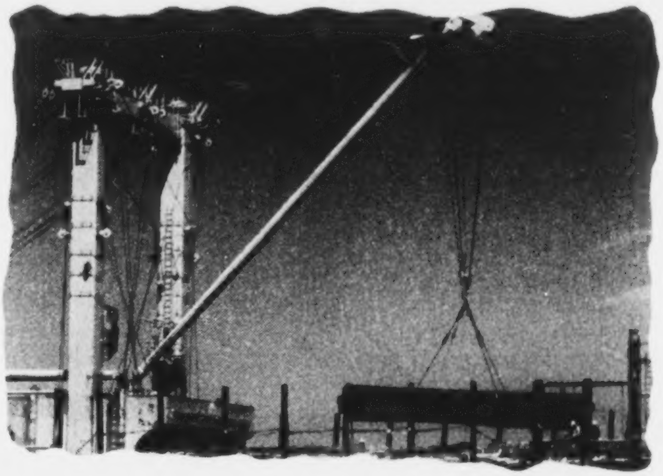
The Jets aren't just a New York football team. There's also a JETS—the Junior Engineering Technical Society—on the Web, at www.asee.org/jets.

# Material Moving Equipment Operators

**Has construction equipment always interested you?**

**Do you have a good sense of balance?**

**Are you mechanically inclined?**



You were the kid who knew the difference between a bulldozer and a front-end loader before you were in kindergarten. Your favorite toys were trucks, which you used to excavate your living room carpet. You still get a thrill when you see a crane lifting steel girders to the top of a skyscraper under construction.

You may want to think about a career as a material moving equipment operator. This good-paying job is ideal for people who want to earn a living operating these huge machines.

## What's It All About?

From the building of the pyramids in ancient Egypt to construction of the World Trade Center's twin towers in the latter part of this century, people have always wanted to build. Today, the people who do much of that work operate many types of highly specialized construction equipment.

You can find material moving equipment operators on any project that uses construction equipment. They operate cranes, bulldozers, front-end loaders, rollers, backhoes, graders, dredges, hoists, drills, pumps and compressors—anything that can "push, pull, pump or lift material, that rolls on tires or crawls on tracks like a tank," according to one equipment operator.

All this heavy machinery is used to move construction materials, earth, petroleum products, coal, grain, manufactured goods and other heavy material. Usually it isn't moved very far—from the ground to the top of a building under construction, from ship to shore, from one side of a construction site to another, from a warehouse shelf to a waiting semi truck.

People in this occupation are classified by the type of equipment they operate. Each type of equipment requires different skills to move different types of loads.

*Crane and tower operators* lift materials, machinery or other heavy objects from the ground. These are the people you see at office building and other construction sites, but in fact, the largest group of crane and tower operators work in manufacturing industries that use heavy, bulky materials.

*Excavation and loading machine operators* dig and load sand, gravel, earth or similar materials into trucks or onto conveyors. They operate machinery equipped with scoops, shovels or buckets. Nearly all of them work in construction.

*Grader, dozer and scraper operators* gouge out, level and grade earth on vehicles with large curved blades on the front—bulldozers, road graders, trench excavators and similar equipment. Most of these operators work in mining and construction, but a large number also work for local and state governments.

## Job Outlook

A 10 percent increase, to 1.21 million jobs, by 2006. While the number of jobs in manufacturing may fluctuate due to computerization and other factors, the number of jobs in construction is expected to increase, with the nation's intrastructure of highways, bridges and dams needing major repairs and replacements.

*Industrial truck and tractor operators* drive and control the trucks and tractors that lift heavy materials. These include forklifts and lift trucks. They use this equipment to carry loads on a skid or pallet around the factory or warehouse. They also may pull trailers loaded with materials, goods or equipment within factories and warehouses or around outdoor storage areas. About half of all jobs for material movers are in this category.

*Operating engineers* know how to use several types of moving equipment. They also may operate compressors, pumps and other power equipment.

You may find material moving equipment operators at work in mines and at railroad yards. Some run ship loading and unloading equipment.

## What's It Really Like?

You need excellent coordination to be successful in this job. Depending on the type of equipment, you'll use hand and foot levers or pedals, turn dials and operate switches.

Except for industrial truck and tractor operators, who work indoors for the most part, almost all the work performed by material moving equipment operators takes place outdoors, in all kinds of weather and conditions. You can expect to be cold in the winter and hot in the summer. And dirty, greasy, muddy and dusty most all the time.

Since most projects are outdoors, work is directly affected by the local climate. In certain climates the construction industry as a whole has a slowdown or shutdown period during the winter season. The length of this period depends on weather conditions—it can last anywhere from several weeks to several months. You may spend several months drawing unemployment.

Still, there is tremendous satisfaction in the job. You'll know that you helped build the skyscraper that dominates the skyline of your community, or the road that carries thousands of people to work every day, or the dam that brings fresh drinking water to families across the state.

You may have to work overtime or on weekends. Sometimes employers want to make the most of favorable working conditions or need to catch up on days missed because of bad weather.

## How Do I Get a Job and Advance?

Most material moving equipment operators learn their skills on the job. Employers prefer people with a high school diploma. Some high school training in auto mechanics is helpful. So is experience operating mobile equipment on the farm or in the armed forces.

As a beginner, you'll operate light equipment under the guidance of a more experienced operator. As your skills improve, you'll graduate to heavier equipment like bulldozers and cranes.

There are a growing number of apprenticeship programs, and graduates of these programs find themselves in demand. These three-year programs include at least 6,000 hours of on-the-job training and 144 hours of classroom instruction. Apprentices learn how to operate a wide variety of machines, which makes them more employable.

Generally, people in this occupation advance by operating more sophisticated machinery. They also may become an operating engineer trained to operate several different types of equipment.

## How Much Money Will I Make?

Earnings vary widely, depending on the type of equipment you operate. Crane and tower operators generally earn the most—about $28,600 on average. Industrial truck and tractor operators earn the least—an average of about $21,500. Pay scales are usually higher in large cities. When the economy is healthy there's lots of work, but when the economy slows down (such as during a recession), so does the availability of work—sometimes for a long time.

## To Learn More

For general information about the work of construction equipment operators, contact the International Union of Operating Engineers, 1125 17th St. NW, Washington, DC 20036 (www.iuoe.org); or the Associated General Contractors of America, 1957 E St. NW, Washington, DC 20036 (www.agc.org).

### Did You Know?

**One of the greatest building accomplishments of the ancient world was construction of the Great Pyramid in Egypt. It is estimated that it took 100,000 workers more than 20 years to build it.**

# Plumbers and Pipefitters

**Do you like solving problems?**

**Do you enjoy working with tools?**

**Are you safety conscious?**

A new hotel needs a sprinkler system installed so guests will be safe in case of fire. A high-tech computer manufacturing facility must keep parts cooled below a certain temperature. A hospital is installing complicated medical gas piping.

All these jobs require the expertise of plumbers and pipefitters. People in this industry can be found in just about every aspect of construction that involves piping—from the space program, to nuclear power generators, to refineries, to shipbuilding, to homes, office buildings and factories. Plumbers and pipefitters lay the oil and gas pipelines that bring energy to your community. They also keep the plumbing, heating and cooling equipment in your home, school or office up and running.

## What's It All About?

If you have a leaky faucet or a stopped drain, you know a plumber can fix your problem. If you need a new dishwasher installed, you'd again know to call a plumber. But you may not know about the many other ways in which plumbers and pipefitters improve the quality of your life.

Plumbers and pipefitters install, maintain and repair many of the pipe systems found in homes, offices, factories and other establishments—from the pipes that bring clean water to your home and carry away waste, to those that bring in the gas that runs your furnace, to the pipes that carry steam to power huge turbines in power plants. Pipefitters and plumbers keep these systems in working order.

Although this is considered a single trade, there are areas of specialization. *Plumbers* install and repair the water, waste disposal, drainage and gas systems in homes and commercial buildings. They install plumbing fixtures—sinks, commodes, bathtubs. They also install appliances—dishwashers, washing machines, water heaters.

*Pipefitters* install high- and low-pressure piping systems that are used in manufacturing, in the generation of electricity and in heating and cooling buildings. Within pipefitting, there are further areas of specialization. For example, *steamfitters* install only the pipe systems that move liquids or gases under high pressure. *Sprinklerfitters* install automatic fire sprinkler systems in buildings.

Depending on the type of project, plumbers and pipefitters work with many different types of materials. For a home water system, they're likely to use copper, steel or plastic piping. For a municipal sewage system, they'd use large cast-iron pipes.

However, all plumbers and pipefitters need some of the same basic skills. They must be able to follow building plans or blueprints, and translate that informa-

### Job Outlook

**[illegible] of jobs in the [illegible]d to increase by [illegible] 406,000, by 2006. [illegible] and pipefitters [illegible] than most work- [illegible] during reces- [illegible]aining and [illegible] pipe systems [illegible]vide job oppor-**

tion into an efficient work scenario. They must know how to use a variety of tools to cut, bend and connect different types of pipes.

## What's It Really Like?

This is a job that requires both physical strength and stamina. When installing a pipe system, plumbers and pipefitters may have to cut holes in walls, ceilings or floors. They may have to hang steel supports to hold the pipes in place. They may be asked to cut and bend lengths of pipe using saws, pipe cutters and pipe-bending machines.

They also may need to make on-the-spot adjustments. "Especially in older houses, there may be no blueprints," says Steve, a plumber who owns his own business. "Or the blueprints that exist may not be accurate. If you discover electrical wiring where you planned to run the plumbing pipes, you need to figure out another way to get the job done."

Generally, plumbers and pipefitters work a 40-hour week. They may have to work evenings or weekends on occasion, and they may need to be on call. In the past, many organizations with large pipe systems employed their own plumbers or pipefitters. Today, to keep labor costs down, these organizations may instead sign a service contract with a business that specializes in the plumbing or pipefitting needed.

As with all jobs, some aspects are less pleasant than others. Sometimes plumbers and pipefitters have to work outside in severe weather. There are potential health hazards—for example, burns from hot pipes or soldering equipment. Plumbers also may have to deal with pipes that are plugged up with distasteful matter, like human waste.

But on the whole, people in this occupation say they get tremendous satisfaction from knowing they've done a good job. "When I turn on the faucet and clean water comes out, I know I have made that family's life better," says Steve.

## How Do I Get a Job and Advance?

Most plumbers start as apprentices. Typically, the local chapter of the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada will cooperate with local employers to run the apprenticeship program. There are some nonunion apprenticeship programs as well.

Apprentices can look forward to four or five years of training, including both practical, on-the-job training and at least 144 hours per year of classroom instruction. Students learn drafting and blueprint reading, mathematics, applied physics and chemistry, safety and local building codes. On the job, they learn how to identify the various grades and types of pipes, how to use the tools of the trade and how to work safely.

To apply for one of these programs, you must be at least 18 years of age and in good physical condition. You may need a high school diploma or GED. Military experience as a plumber or pipefitter is helpful. So are high school courses in drafting, general mathematics, technology, applied physics and drafting.

Most communities require plumbers to be licensed, which involves passing an exam that tests knowledge of the trade and local plumbing codes. Once you're on the job, you can take advantage of certification programs to qualify for more specialized responsibilities. Certification programs include valve repair, medical gas installation, welding, chlorofluorocarbon removal and instrumentation (in many buildings, automatic controls are used to regulate heating and cooling systems, and pipefitters must know how to install and regulate these systems).

Plumbers and pipefitters may advance by becoming supervisors for a mechanical or plumbing contractor. Others go into business for themselves.

## How Much Money Will I Make?

The average salary for plumbers and pipefitters who are not self-employed is about $30,700. Apprentices usually start at about half that salary, with increases as they improve their skills. Many plumber and pipefitters who work for themselves make more than $50,000 annually.

## To Learn More

For information on apprenticeships and training as a plumber or pipefitter, contact the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada, 901 Massachusetts Ave. NW, Washington, DC 20001; (202) 628-5823 (www.ua.org).

General information on the work of plumbers, pipefitters and sprinklerfitters is available from the National Association of Plumbing-Heating-Cooling Contractors, 180 S. Washington St., P.O. Box 6808, Falls Church, VA 22046; (800) 533-7694 (www.naphcc.org); or from the Associated Builders and Contractors, 1300 N. 17th St., Arlington, VA 22209 (www.abc.org).

### Did You Know?

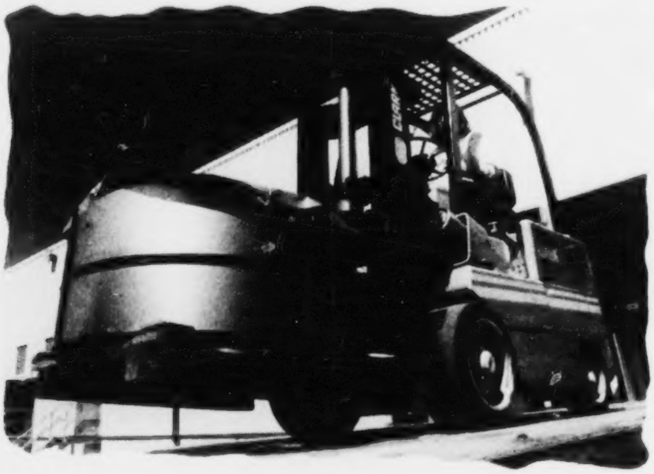
The first sewers were built in Rome about 800 B.C. At that time, most plumbers were women.

# Sheetmetal Workers

**Can you follow complex schematics?**

**Do you enjoy working with tools?**

**Do you have the strength to handle heavy materials, tools and machines?**



It's summer and a heat wave has turned your house into an oven. You flip a switch and within minutes, cool air is sent to every corner of your house.

A sheetmetal worker is responsible for that cool air—having made the duct work that carries the cool air from the air-conditioning unit to each room in the house. Sheetmetal workers also installed the ductwork and would come out to maintain it if it needed repair. They are involved in fabricating and installing many products that make our lives easier and more pleasant.

## What's It All About?

Sheetmetal workers make, install and maintain duct systems used in air-conditioning, heating, ventilation and pollution control systems. They also fabricate a wide variety of other products: aluminum siding for homes, rain gutters and downspouts, roofs, skylights, restaurant equipment, outdoor signs and many other building parts and products that are made from metal sheets. And they may shape and form sheets of fiberglass or plastic into a similar variety of products.

Most of the work of fabricating sheetmetal pieces is done in a shop away from the construction site. Workers study plans and specifications to determine the kind and quantity of materials they will need. Then they select the metal stock needed for stainless steel, galvanized steel, mild steel, aluminum, copper and other materials. They check the sizes, gauges and other dimensions of the material.

Next, they mark out stock with reference points and lines, using templates, gauges and other measuring instruments. In a growing number of shops, sheetmetal workers use computerized metalworking equipment, which makes it easier to experiment with different layouts so there is as little wasted material as possible. If the shop is not computerized, workers rely on calculators to do their figuring and then use tapes, rules and other measuring devices to lay out the work.

Once everything is laid out, workers use hand or power shears, guillotines or drills to cut the material. With machines like brake presses, folding and bending machines, riveters, rollers, guillotines, drills or spot welders, they shape and form-cut the material into ductwork, counter tops or other custom products.

Before any piece is assembled, it's checked and double checked for accuracy. If necessary, workers finish it with hand, rotary or squaring shears and hacksaws. After all the parts have been inspected, workers fasten the seams and joints together—riveting, bolting, welding, brazing or soldering them.

At the job site, workers further assemble the pieces as they install them. They

## Job Outlook

An increase of about 15 percent to 126,500 jobs by 2006. A growing demand for more energy-efficient air-conditioning, heating and ventilation systems in older buildings, as well as other types of renovation and maintenance work, should boost employment.

join ducts, pipes or tubes end to end and hang them with metal hangers that are secured to a ceiling or wall. They also use shears, hammers, punches and drills to make parts at the work site or to alter parts made in the shop.

Some pieces are made entirely at the job site. Metal roofs, for example, are measured, cut and installed on site. Workers install the first panel. Then they interlock and fasten the grooved edge of a second panel to the grooved edge of the first, nail or weld the free edge to the structure and repeat. Finally, they fasten machine-made molding at all the joints, along corners and around corners and doors.

## What's It Really Like?

Some sheetmetal workers specialize in fabrication, others in installation and still others in maintenance. But most people in this profession have all three skills. That means their working conditions may vary widely from one day to the next.

Fabrication takes place in a sheetmetal shop. Sheetmetal workers there stand for long periods and lift heavy materials and finished pieces. The high-speed machines can be dangerous, so workers need to observe strict safety precautions. Workers wear goggles to protect their eyes from bits of metal. They must not wear loose-fitting clothing or jewelry, since either could get caught in the machine.

Installation takes sheetmetal workers to job sites. If they're installing a roof, gutters or siding, they'll need to climb ladders, often carrying large and ungainly pieces of fabricated metal with them. Installation also involves considerable bending, lifting, standing and squatting, sometimes in close quarters or awkward positions. This work goes on in all kinds of weather.

Sheetmetal workers usually work a 40-hour week. Workers in this field typically are involved with both new construction and maintenance. That means this job is less sensitive to declines in new construction than are some other construction trades. And since a large proportion of sheetmetal installation and maintenance is done indoors, workers in this job usually lose less work time due to bad weather than other construction workers. All that adds up to a trade that promises steady work.

## How Do I Get a Job and Advance?

Apprenticeship is the best way to learn this trade. Training programs last four or five years, include a minimum of 144 hours of classroom instruction and are administered by local chapters of the Associated Builders and Contractors or local joint committees of the Sheet Metal Workers International and local chapters of the Sheet Metal and Air Conditioning Contractors National Association.

Trainees learn the basics of pattern layout and how to cut, bend, fabricate and install sheetmetal. They start by working on basic ductwork. Gradually they advance to more complex ductwork, fittings or even decorative pieces. They also learn how to bend and shape materials such as fiberglass and plastics.

In the classroom, apprentices study drafting, plan and specification reading, and trigonometry and geometry that applies to layout work. They work with computerized equipment and learn how to create alternate layouts to make maximum use of raw materials. They learn to weld and they study the principles of heating, air-conditioning and ventilating systems. They also learn how to do each of these complicated jobs safely.

A few people pick up the trade on the job. They start as helpers and then learn to operate machines that bend and cut metal. In time, they go out to a job site to learn installation. Most people who learn the trade in this way still must take vocational classes in mathematics or sheetmetal fabrication. To be promoted to the journey level, helpers usually must pass the same written examination as apprentices.

Applicants for either apprenticeships or helper jobs should be in good physical condition and have both mechanical and mathematical aptitude. A high school degree or its equivalent is required for most apprenticeship programs. Courses in algebra, trigonometry, geometry, mechanical drawing and technology are helpful for those who wish to enter the trade.

There are always new things to learn in sheetmetal work. For example, the growing use of computerized layout and laser-cutting machines has brought new technology to this trade. Workers often take additional training provided by the union or by their employer.

Some sheetmetal workers become supervisors. Some take additional training in welding and do more specialized work. Still others go into business by themselves, although the machinery involved in sheetmetal work makes this type of business more expensive to start than other types of construction contracting.

## How Much Money Will I Make?

The average salary for sheetmetal workers working full time is about $25,900. The top 10 percent in salary earn considerably more—as much as $53,000. Apprentices usually start at about 40 percent of the rate paid to experienced workers. Geographic location also affects wage rates.

## To Learn More

For general information about sheetmetal workers, contact the International Training Institute For the Sheet Metal and Air Conditioning Industry, 601 N. Fairfax St., Suite 240, Alexandria, VA 22314 (www.sheetmetal-iti.org). It's part of the Sheetmetal and Air Conditioning Contractors Association, which can be reached at 4201 Lafayette Center Drive, Chantilly, VA 22021 (www.smacna.org).

### Did You Know?

**Some sheetmetal workers specialize in architectural restoration. They copy designs used on decorative metalwork for people who are restoring older homes and buildings.**

# Health Care

# Clinical Laboratory Technologists and Technicians

**Do you enjoy problem solving?**

**Are you precise and accurate?**

**Can you work well under pressure?**

Doctors "used to have to do a lot of guessing when we were trying to figure out what was wrong with a patient," says Art, a pediatrician. "Today, thanks to advances in medical technology, we're much more likely to know."

To diagnose health problems accurately, physicians rely on an increasingly sophisticated battery of medical laboratory tests. The people who perform those tests, analyze the data and report the results to physicians are known as clinical laboratory technologists and technicians. Today their skills are more in demand than ever.

## What's It All About?

Clinical laboratory technologists and technicians provide data necessary for the detection, diagnosis and monitoring of a disease and its treatment. Within this general field there are many different occupations.

*Medical technologists* test for bacteria, drugs or diseases, such as leukemia, diabetes, cancer and HIV/AIDS. Using microscopes, computers and chemicals, they prepare and study body tissues and fluids. They make cultures of body fluid or tissue samples to see whether they contain bacteria, fungi, parasites or other microorganisms. They analyze samples for their chemical content and determine blood glucose and cholesterol levels. They provide data so doctors and researchers can determine the presence and extent of disease. They also type and cross-match blood samples and transfusions. Some medical technologists also supervise medical and clinical laboratory technicians.

*Blood bank technologists* collect, type and prepare blood and its components for transfusions. Human blood can be classified into four types—type A, type B, type O and type AB. A person with blood of one type who receives blood of another type could have a serious or even fatal reaction. Blood bank technologists test blood for abnormal conditions, especially those that occur in newborns. They can establish and manage donor and frozen blood programs. They also manage the administrative and technical aspects of blood banks.

*Cytotechnologists* mount samples of the body's cells on slides and study them under a microscope. They look for clues—such as changes in cell structure, color, shape and size—that could indicate cancer or pre-cancerous growths. They report their findings to a pathologist (a physician specializing in the origins and nature of diseases) for further study. A common test that cytotechnologists analyze is the PAP smear, which detects cervical or uterine cancer. Cytotechnologists also may study samples to detect colon, mouth and lung cancers.

*Immunology technologists* examine the responses of the human immune system

## Job Outlook

A 15 percent increase, to 328,000 jobs, by 2006.

to foreign bodies, while *histology technicians* are experts in slide preparation. The latter immerse tissues in fluid to prevent decay, replace the specimen's water with wax and set the tissues in wax. They slice tissues, prepare slides and apply dyes. The samples they create may be used for teaching, research or diagnosis.

*Medical laboratory technicians* usually work under the supervision of pathologists or medical technologists. They collect, type and group blood. They stain slides and perform routine tests on the body's blood, tissues and fluids. They keep records and clean and sterilize equipment. They use microscopes, computers and other laboratory equipment to gather data and help in the diagnosis and treatment of diseases.

*Phlebotomists* collect and process the blood to be analyzed. Much of their time is spent with patients. They calm down nervous patients before drawing blood. They use their skill to draw blood with the least possible discomfort to the patient. Because they risk exposure to diseases such as HIV/AIDS, they pay extremely close attention to safety procedures. Phlebotomists usually work under the supervision of medical and clinical laboratory technologists or laboratory managers.

The complexity of the tests you may perform, the level of judgment needed and the amount of responsibility you will be allowed to assume depend largely on your education and experience.

## What's It Really Like?

To be successful in this work you need great precision, accuracy and patience. You must pay close attention to detail, since even a small difference or change in a test substance or a numerical readout can be crucial information to the physician making the diagnosis.

You need to work well under pressure. You also need good analytical skills. If you see something that looks at all unusual, you have a responsibility to note it and pass the information on to the physician and the patient. You should think of yourself as a problem solver. You also need manual dexterity, especially if you are a histology technician or a phlebotomist.

Computer skills are increasingly important in this field. Many tests are computerized, and data may be recorded and transmitted to the physician via computer.

There's always a risk of infection in this job. In the era of AIDS, it is essential that technologists and technicians take meticulous safety precautions to protect themselves from disease.

Many technologists and technicians work in hospitals. There, they may expect evening, weekend and holiday shifts. In other labs, they might expect to be on call in case of emergency.

## How Do I Get a Job and Advance?

Typically, you need a bachelor's degree to qualify for an entry-level position as a medical or clinical laboratory technologist. If you major in medical technology, you'll take courses in chemistry, biological sciences, microbiology and mathematics. You'll also learn the skills you need in the lab. Many programs today also require courses in management, business and computer applications. To qualify as a technician, you usually need an associate's degree from a community or junior college or a certificate from a hospital, vocational or technical school or from the armed forces.

Some states require people who work in labs to be licensed. Even if a license is not required in your state, you may want to consider certification, which is a requirement for many jobs and is often necessary for job advancement.

Technicians may advance to technologists with additional training and education. Technologists, in turn, may become supervisors or laboratory managers in hospitals. You may need an advanced degree to become a director of a laboratory, however.

## How Much Money Will I Make?

The average salary for a medical technician is about $26,500. Laboratory technologists earn considerably more—an average of about $35,100. Medical technologists who work for the federal government can expect to earn about $40,600.

## To Learn More

For information on a career as a clinical laboratory technologist or technician, contact American Medical Technologists, 710 Higgins Road, Park Ridge, IL 60068 (www.amt1-.com); or the American Society for Clinical Laboratory Science, 7910 Woodmont Ave., Suite 530, Bethesda, MD 20814 (www.ascls.org).

To find out whether your state requires laboratory technicians and technologists to be licensed, contact the state's department of health or the state board of occupational licensing.

### Did You Know?

**Clinical technologists and technicians could tell you that people who live at high altitudes, where the air contains less oxygen, may have up to two quarts more blood than people who live at low altitudes.**

# Dental Hygienists

**Are you precise and detail-oriented?**

**Are you interested in a job that lets you work part time or have a flexible schedule?**

**Do you like working with people?**

*"Open wide, please."*

These days, the person who says that to you in the dentist's office may not be a dentist. More and more often, the dental hygienist is the first person who sees the patient. From cleaning teeth, to teaching patients about caring for their teeth and gums, to using some of the latest high-tech equipment, dental hygienists have taken on more responsibility for oral health.

## What's It All About?

"This job involves a lot more than cleaning teeth," says LaToya, who just started her first job as a dental hygienist. She's right—today's dental hygienist has many responsibilities.

Dental hygienists take health histories. They examine a patient's head, neck and mouth for disease and record what they find. This helps the dentist zero in on potential problem areas. Hygienists perform screenings for oral cancer and remove hard and soft deposits of tartar, stain and plaque from tooth surfaces above and below the gum line.

Hygienists help patients learn how to properly take care of their teeth and gums. They might explain the effects of diet on teeth to one patient, then show a young child how to brush her teeth, then describe the harmful effects of smokeless tobacco to a teenage boy who has just started to "chew."

Dental hygienists use a lot of equipment, some of it high tech. They use both hand and rotary instruments to clean teeth. They may use ultrasonic cleaners and computerized digital X-ray machines. In states where dental hygienists can administer anesthetics, they may do so, using syringes with needles.

Hygienists may place and carve fillings for teeth. They may even apply a temporary filling. In many offices, they perform jobs that once were done only by dentists, leaving the dentist free to do the most difficult work.

## What's It Really Like?

"This is a great job if you need flexibility," says Lynne, a dental hygienist. "When I was just out of school, I worked full time. Later, when my kids were young, I cut back my hours and worked just one day a week. Now I work two days a week, which is perfect for me." Lynne is not alone—dental hygienists say the job's flexible hours are one of the main benefits. Part-time work is common in the profession.

Many dentists hire hygienists to work only two or three days a week. If you want a full-time job that may mean holding jobs in more than one dental office.

Naturally, cleanliness is a major responsibility of dental hygienists. With recent concerns about AIDS and other

## Job Outlook

**The job** of dental hygienist is **projected** to be one of the 20 **fastest-growing** occupations **over the next** several years. The **number** of jobs is expected to **increase** by 48 percent, to 197,000, by 2006.

infectious diseases, dental hygienists today wear safety glasses, surgical masks and gloves to protect themselves and patients.

Dental hygienists spend most of their time working on patients, so they need to be comfortable with people and have good social skills. They must be detail oriented and have good manual dexterity because they use dental instruments with very little margin for error in a patient's mouth.

## How Do I Get a Job and Advance?

You must be licensed by the state in which you practice in order to work as a dental hygienist. That means you need to graduate from a dental hygiene program and pass both a written and a clinical examination. Dental hygiene programs are a minimum of two years but can be as long as four years.

To be admitted to a dental hygiene program, as a general rule you must have a high school diploma or a General Equivalency Diploma (GED), be at least 18, have a minimum "C" average in high school and have taken high school courses in chemistry, biology, English and mathematics. Once you are admitted to the dental hygiene program, you will take courses in many areas, including:

- general education—including English, speech, psychology and sociology
- basic science—including chemistry, anatomy, biochemistry, nutrition and pharmacology
- dental science—including dental anatomy, peridontology (the study of gum disease), pain control and dental materials
- dental hygiene science—including clinical dental hygiene, medical and dental emergencies including basic life support, and oral health education.

While most dental hygienists work in dentists' offices, there are other career options. These include:

- community health programs
- school systems
- hospitals
- military bases
- health maintenance organizations
- long-term care facilities
- foreign countries.

Dental hygienists with a bachelor's degree may also work in research or teaching.

## How Much Money Will I Make?

Salaries for dental hygienists vary widely. Your education, experience and even your geographic location will affect your earnings. On average, dental hygienists who work 32 hours a week earn $37,950 per year.

Benefits also vary substantially, depending on where you work and for how many hours a week; they may be contingent on full-time employment.

## To Learn More

For information on a career in dental hygiene or a list of what you need to be admitted to a dental hygiene program, contact the Division of Professional Development, American Dental Hygienists Association, 444 N. Michigan Ave., Suite 3400, Chicago, IL 60611 (www.adha.org).

To learn about accredited programs, contact the Commission on Dental Accreditation, American Dental Association, 211 Chicago Ave., Suite 1814, Chicago, IL 60611 (www.ada.org).

To find out the specific requirements for licensing in your state, contact your state's board of dental examiners.

**Did You Know?**

**More than half** of all dental **hygienists** work part time

# Dental Laboratory Technicians

**Can you recognize very fine color shadings and variations in shape?**

**Are you precise and detailed?**

**Do you want to work with your hands?**

Your little brother slid into third base. Unfortunately, he left his front tooth on second base.

Your mother's left molar broke off when she bit into a piece of hard candy. She needs a crown so she can chew normally again.

Your sister has a pretty face ... until she smiles. Then her crooked teeth are all anyone looks at.

All these people will need the services of a dental laboratory technician. Whether you need a crown, a bridge, a set of dentures or other dental prosthetics, you'll need the skill of such a dental specialist.

## What's It All About?

You probably don't spend a lot of time thinking about your teeth. But if you lose a tooth through accident or illness, you soon learn how important teeth are to your overall health and well-being. Usually teeth that have been lost need to be replaced. This is called restorative (or prosthetic) dentistry.

In other cases, teeth must be moved or stabilized. This is called orthodontic treatment. The dentist plans the treatment and places the restoration or corrective device in the patient's mouth. But behind the scenes, the dental laboratory technician is actually responsible for fabricating the restoration or device.

As a dental laboratory technician, you fill prescriptions from dentists. Whether it's a crown, a bridge or an orthodontic device, the dentist sends a specification of the item to be fabricated, along with a mold of the patient's mouth, called an impression.

The technician starts by creating a model of the patient's mouth by pouring plaster into the impression and allowing it to set. He or she then places the model on a special apparatus that allows the technician to recreate the bite and movement of the patient's jaw.

First the technician builds a wax tooth or teeth, using special, small hand instruments. That wax tooth is used to create the cast for a metal-and-porcelain device. The technician uses small handheld tools to prepare the surface of the metal. Then he or she applies porcelain in layers so the tooth is exactly the same size and shape as the one it's replacing. The technician bakes the tooth in a porcelain furnace, then continues to grind or add more porcelain until it's the proper shape. Once the device is finished, it should be an exact replica of the lost tooth or teeth.

## What's It Really Like?

Everyone's mouth is different, so each restoration is unique. It's a challenge to recreate both the perfection and the imperfection of natural teeth.

This is delicate, time-consuming work. You need good eye-hand coordination and color perception, dexterity in

## Job Outlook

Although the number of jobs is expected to increase by only about 1 percent, to 48,000 jobs by 2006, there are plenty of job opportunities in this field. Employers have trouble filling trainee positions—possibly because not many people know about this occupation.

using small instruments and the patience to attend to minute detail.

You also need to understand the science involved with the materials you use. For example, if you're creating a so-called "fixed restoration" (something that's going to remain in place, like a crown or a bridge), you need to understand ceramics, plastics and metal alloys. For a "removable restoration" like dentures or a corrective device like braces, you need to understand physical forces and the characteristics and handling properties of wires and plastic materials.

Most dental technicians are employed in commercial dental laboratories, which provide services to a number of different dentists. Commercial dental laboratories often are very small—perhaps just two or three employees—but some employ more than 200 people. Private dental offices may have their own laboratory, usually with just one or two technicians doing the laboratory work for the dentists practicing in that office.

If you work in a small lab, you will probably take a single job from start to finish. In a larger lab, you may specialize in a particular task. Your job title may reflect your area of specialty—for example, a technician who makes porcelain and acrylic restorations is known as a dental ceramist.

## How Do I Get a Job and Advance?

Most dental laboratory technicians learn on the job. You might start by doing something simple—pouring plaster into an impression, for example. Gradually, you work up to more complicated tasks like making porcelain crowns or bridges.

There are some training programs in community and junior colleges, vocational-technical schools and the armed forces. The best are those accredited by the Commission on Dental Accreditation in conjunction with the American Dental Association.

In a formal training program, you'll get classroom instruction in dental materials science, oral anatomy, fabrication procedures, ethics and other related subjects. In addition, you'll get practical experience in the school or in a dental laboratory.

Even with a two-year degree, you should expect to get some additional training before you are fully qualified. All labs work a little differently, so you shouldn't be surprised if you need more hands-on training after you're on the job.

While you're still in high school, you should take courses in art, industrial technology, drafting and sciences. If you're planning to go into business for yourself, courses in management or business also may be helpful.

States set no minimum qualification for people to be employed as dental technicians. Technicians with at least five years of experience may, however, wish to take the examinations to become a certified dental technician. Certification is offered in one of five specialty areas: crowns and bridges, ceramics, partial dentures, complete dentures and orthodontic appliances.

New materials, techniques and equipment are regularly introduced to dental technology, so it is essential that you continue your education once you're on the job. Sometimes technicians advance by taking jobs with dental suppliers, or by becoming a supervisor or a manager in a large laboratory. More typically, they advance by opening their own laboratory—about one in seven dental laboratory technicians is self-employed, and many work in dental laboratories in their home in addition to holding a regular job.

## How Much Money Will I Make?

The average salary for all workers in dental laboratories is about $23,700. Within a lab, wages vary significantly, however. Those who are starting out as a trainee may earn only a little more than minimum wage. But a technician who is very productive, or who develops a specific skill—for example, the ability to carve replicas of lost teeth—can expect to earn $50,000 or more. In general, self-employed technicians and those who work in small laboratories earn more than those who work in large labs.

## To Learn More

For a list of accredited programs in dental laboratory technology, contact the Commission for Dental Accreditation, American Dental Association, 211 E. Chicago Ave., Chicago, IL 60611 (www.ada.org). For information on a career as a dental laboratory technician, contact the National Association of Dental Laboratories, 555 E. Braddock Road, Alexandria, VA 22314 (www.-nadl.org).

### Did You Know?

George Washington could have used a dental laboratory technician. He wore ill-fitting false teeth—but they weren't made of wood, as you may have read. They were made of a combination of cow's teeth, one of his own teeth, hippopotamus ivory, metal and springs.

# Dietitians and Nutritionists

**Are you interested in healthy eating?**

**Do you like working with people?**

**Do you want to help people look good and feel better?**

You've heard the old saying, "You are what you eat." Well, it's true—health, nutrition and fitness have become a way of life for many people. And that's good news for dietitians and nutritionists, since their expertise is in real demand.

In the past, most dietitians worked in hospitals. Today, as more and more people are concerned about the food they eat, job opportunities for dietitians and nutritionists are expanding. You'll find these professionals in health care, education and research. They're also at work in government, restaurant management, fitness, food companies and private practice.

## What's It All About?

Dietitians and nutritionists are experts on food and nutrition. Their job has become a high-tech field that involves applying what they know about food and nutrition to help people lead healthier lives.

The work you'll do depends on the type of job you get. If you work as a clinical dietitian in a hospital or a nursing home, you'll develop nutrition programs designed to meet patients' health needs. You may be responsible for designing a low-cholesterol diet for a heart patient one day and a low-calorie diet for an overweight patient the next day.

Since most doctors have little training in nutrition, they are beginning to recognize that dietitians are a valuable part of a health care team. In hospitals, nursing homes, health maintenance organizations and other health care facilities, you'll find dietitians and nutritionists working with doctors, nurses and therapists to help speed patients' recovery and lay the groundwork for long-term health.

*Community dietitians* work in public- and home-health agencies. They also may work for government-funded programs that feed and counsel families, pregnant women, senior citizens, children or disabled people. "I teach a class for low-income mothers," says Amy, a health department dietitian. "Showing them how to stretch their food budgets and provide nutritious meals for their children is one of the most satisfying parts of my job."

*Management dietitians* work in schools, cafeterias, restaurants or health care facilities. They may plan menus and manage everything from purchasing to personnel. As more and more people recognize the importance of good nutrition, you're likely to find a management dietitian at work anywhere food is served.

*Business dietitians* work in food- and nutrition-related industries. They may work on the development of new products. They also may work in public relations, sales, marketing or advertising.

## Job Outlook

An 18 percent increase, to 69,000 jobs, by 2006. While the number of jobs in hospitals is expected to decline, increases are seen in the number of nutritionists and dietitians working in nursing homes, for food service companies or as part of a team of doctors and health care providers.

*Research dietitians* work in major universities and medical centers, in government agencies, or for food or pharmaceutical companies. They conduct experiments to answer critical questions about nutrition. They may try to find alternative foods—for example, helping a company develop a low-fat alternative to a favorite snack food. Research dietitians also are responsible for making recommendations about nutrition to the public; for example, research dietitians developed the Food Guide Pyramid, which shows what foods comprise a healthy diet.

Also, a growing number of dietitians and nutritionists run their own business. They may offer advice on weight loss, cholesterol reduction or a variety of other diet-related concerns. Some professional athletes work with a dietitian or a nutritionist just as they would with a strength trainer or a batting coach. As people become more aware of the relationship between nutrition and health, opportunities for dietitians and nutritionists are expanding into new areas.

## What's It Really Like?

There's such a wide variety of opportunities for dietitians and nutritionists that there are plenty of options for matching your interests. Want to work with senior citizens? There are job opportunities in nursing homes and assisted-living facilities. Interested in athletics? Many health clubs now include a nutritionist or dietitian as part of their staff.

If you want the stability of a guaranteed income, you can find a job with a hospital, a food company or a government program. If you're not fazed by the risks of going into business for yourself, you may be able to build a business that allows you to specialize in serving overweight patients, for example—or in designing food programs for kidney patients or those with heart disease.

But even though there's a growing body of research that emphasizes the importance of nutrition, many people still don't use the services of a dietitian or nutritionist. Since health insurance doesn't always cover these services, cost may keep some people from getting the help they really could use. "People won't spend $75 or $100 to consult with a professional dietitian," says Marsha, a dietitian in private practice. "But those same people will go into a health food store and spend the same amount of money for vitamins they don't really need."

As a dietitian or nutritionist, you'll probably work a regular 40-hour work week. If you work in a hospital or other residential facility you may work nights or weekends. Some dietitians—especially those who work for restaurants—may spend time in hot, steamy kitchens. You'll probably be on your feet for most of the day.

## How Do I Get a Job and Advance?

You can start preparing for a career as a dietitian or nutritionist as early as high school. Take as many science courses as you can—biology, anatomy and chemistry are all subjects you must study. If your school offers family and consumer science courses in food and nutrition, take those, too.

In most states you'll need a license or certificate to work as a dietitian. Usually that means a bachelor's degree with a major in dietetics, foods and nutrition, food service systems management or a related area.

Many dietitians complete an internship or a pre-professional practice program. These may last as long as a year and give you the practical knowledge to go with your studies.

You may decide to specialize in a particular area—for example, nutrition for senior citizens. Or, you may advance to become the head of a department.

If you don't want to spend four years in college, you can earn an associate degree and become a dietetic technician. You'll work in partnership with a registered dietitian in a clinic, food service management, business or community programs such as WIC (Women, Infants and Children; a nutrition program for low-income mothers and children) and Meals on Wheels.

## How Much Money Will I Make?

For full-time dietitians who work in hospitals, the average salary is $34,400. Those who work in food and nutrition management or in private practice earn more—about $43,000 in each case. Those in community or clinical nutrition earn slightly less—about $34,000. More than 60 percent of dietetic technicians earn between $20,000 and $30,000 a year, according to the American Dietetic Association.

## To Learn More

For a list of programs that are approved by the Commission on Accreditation/Approval for Dietetics Education, visit the American Dietetics Association's home page (www.eatright.org/caade) or write to ADA at 216 W. Jackson Blvd., Suite 800, Chicago, IL 60606.

### Did You Know?

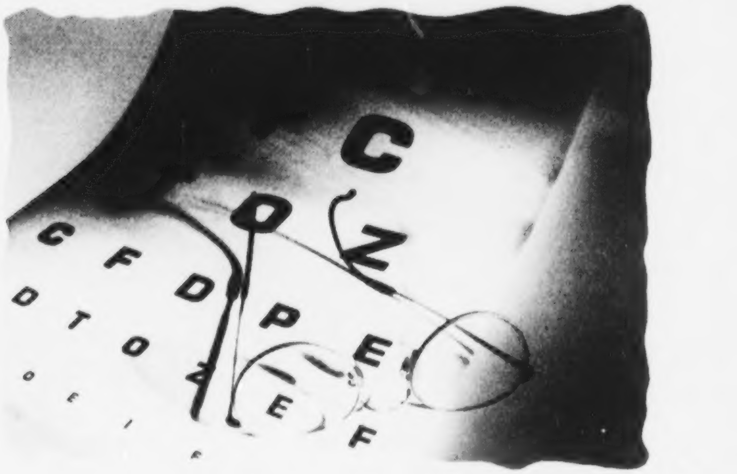
**Poor nutrition** is a root **cause of many** of today's **killer diseases**, including **heart disease**, high blood **pressure** and some cancers.

# Dispensing Opticians

**Do you enjoy working with people?**

**Are you detail oriented?**

**Would you like helping people look good?**



*"I can see!"*

To a dispensing optician, those are rewarding words. "When I can fit a patient with a pair of glasses or contact lenses, and watch the smile on that person's face as he sees clearly for the first time in many months, that gives me a tremendous reward," says Diana, a dispensing optician who owns her own business. "What makes me excited about coming to work every day is knowing that I have improved people's quality of life by helping them see better."

## What's It All About?

Dispensing opticians fit eyeglasses and contact lenses. When a customer walks in with a prescription from an ophthalmologist or optometrist, the dispensing optician helps choose eyeglass frames and lenses.

Dispensing opticians measure a patient's eyes, including the distance between the centers of the pupils and the distance between the surface of the eye and the lens. It's exacting, detailed work—a difference of even a millimeter can have a negative effect on the patient's vision.

Sometimes patients need new eyeglasses but have lost their prescription. Dispensing opticians can use a machine known as a lensometer to record the prescription from the patient's current pair of glasses. They also may call the patient's optometrist or ophthalmologist to get an up-to-date prescription.

Many dispensing opticians prepare work orders that tell laboratory technicians what they need to know to grind and insert lenses into a specific frame. Others do that work themselves. Once the lenses are ground, the dispensing optician makes sure they meet specifications. Then he or she fits the eyeglass frames to the patient.

Patient education is a part of the dispensing optician's job. You might be asked to help a patient who is just adjusting to bifocals, for example. You also may be asked to fix, adjust or refit broken frames.

Some dispensing opticians specialize in fitting contact lenses under the direction of an optometrist or an ophthalmologist. This is a job that requires patience, skill and care. Dispensing opticians examine the patients' eyes, corneas and eyelids with special instruments and microscopes. They measure eye shape and size. Then they choose the best type of contact lens material and prepare work orders that specify the prescription and lens size. Over the course of several visits, the dispensing optician teaches patients how to insert, remove and care for their contact lenses, and makes sure the lenses fit correctly.

Still other dispensing opticians develop a specialty in the area of low-vision correction. Some patients—for example,

## Job Outlook

A 14 percent increase, to 76,000 jobs, by 2006. As the population ages, there should be an increasing demand for dispensing opticians, since middle age is the time when many people begin using corrective lenses.

those with the eye disease macular degeneration or retina damage—have eyes that cannot be corrected by using standard lenses. Some dispensing opticians fit artificial eyes or cosmetic shells to cover blemished eyes.

Finally, some opticians become experts in dealing with patients of a particular age. Whether it's helping those over 40 who are experiencing presbyopia (literally "old eyes") and need to be fitted with reading glasses or advising teenagers who want a pair of contact lenses that will allow them to stay involved with athletics, dispensing opticians need to know as much about people as they do about corrective lenses.

The technology in this field continues to improve. Contact lenses, which once required extensive care, are now available in disposable form. Bifocals, which once had a telltale line across the glasses lens, now have invisible gradations.

## What's It Really Like?

This is a job that involves a lot of contact with people. "You need to ask lots of questions to determine the patient's needs," Diana says. "Each person is different."

Depending on the customer's prescription, occupation, habits and facial features, the dispensing optician also may recommend special coatings, lenses or other special features that will better match the corrective lenses to the person's lifestyle. For a youngster just getting his first pair of glasses, that might mean a recommendation of shatterproof lenses. For a senior citizen who is in and out of the sun all day, it might mean a recommendation for a special coating that darkens the lenses in sunlight.

"Today, most patients see their eyeglasses as a fashion accessory as well as a medical necessity," Diana notes. It's important to be able to offer patients advice about which frame styles look good.

The eyeglasses-as-fashion trend is expected to generate increased business for opticians, as more and more patients buy several pairs of glasses, or purchase colored contact lenses that allow them to change their eye color from blue to green to brown.

About half of all dispensing opticians work for ophthalmologists or optometrists who sell glasses directly to patients. Many work in retail optical stores that offer customers one-stop shopping: Customers have their eyes examined, choose their frames and have glasses made on the spot. Some dispensing opticians work in the optical department of a drug or department store.

Wherever they work, dispensing opticians are likely to have good working conditions. Offices are likely to be clean and well lit. Most dispensing opticians work a 40-hour week, but those who work for large retail stores may be asked to work evenings and weekends.

A growing number of women are entering this field—a 1995 survey found that 57 percent of dispensing opticians are female.

## How Do I Get a Job and Advance?

In the past, most dispensing opticians learned their trade on the job. Today, however, it is increasingly important to have a certificate from an accredited program. Dispensing optician training includes instruction in optical mathematics, optical physics and use of precision measuring instruments and the other machinery and tools used on the job. Most programs last two years, but there are some that are about one year in length.

"If you're considering a career as an optician, see if you can get some practical experience," Diana advises. Perhaps you can get a part-time job in a retail store that sells eyeglasses. While you're in high school, you'd be well advised to take plenty of science and math, including physics, anatomy, algebra, geometry and mechanical drawing.

In 21 states, you must be certified before you can practice as a dispensing optician. Certification is open to graduates of schools of opticianry or those who have earned a certificate from a program in a community college. Those completing a formal apprenticeship, which may take from two to four years, also may be certified.

Opticians may be certified by the American Board of Opticianry and the National Contact Lens Examiners. This certification must be renewed every three years.

Opticians may advance by choosing a specialty area—for example, contact lenses or low-vision correction. They also may become managers of large retail stores. Opening a business is another option for advancement.

## How Much Money Will I Make?

The average salary of dispensing opticians is about $27,400. Owners and managers of stores, as well as certified graduates of opticianry school, have higher salaries. So do opticians in states that require opticians to be licensed.

## To Learn More

For additional information about a career as a dispensing optician, contact the Opticians Association of America, 10341 Democracy Lane, Fairfax, VA 22030; (703) 691-8355 (www.opticians.org).

For information on accredited training programs, contact the Commission on Opticianry Accreditation, 10341 Democracy Lane, Fairfax, VA 22030; (703) 352-8028.

### Did You Know?

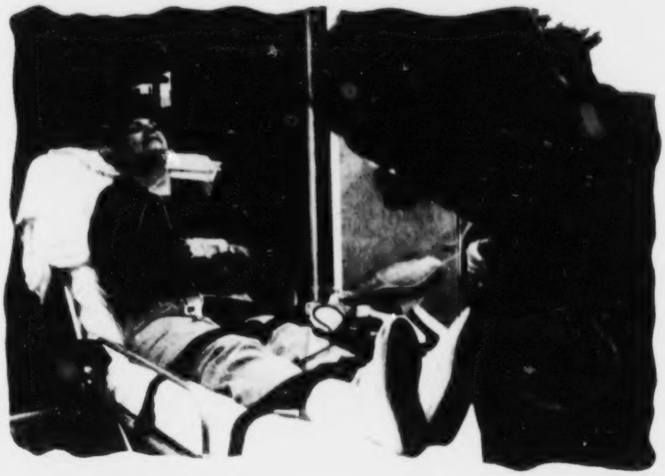
Ninety-eight percent of people over the age of 65 need some type of vision correction.

# Emergency Medical Technicians

**Can you stay level-headed in crisis situations?**

**Do you want a job with lots of action?**

**Can you make good decisions in just a few seconds?**



*"He's stopped breathing!"*

*"The baby's coming—now!"*

*"There's a car wreck on Interstate 40."*

In all these cases—and anytime there's a health crisis or someone is badly injured—people call emergency medical technicians (EMTs). These trained professionals respond in situations where people need immediate medical care and every second counts.

## What's It All About?

If there's a life-threatening medical emergency, sometimes treatment can't wait until the patient gets to the hospital. That's when EMTs step in. They give immediate care and often transport sick or injured people to hospitals.

EMTs work as part of a team of professionals who are trained to handle medical, fire, rescue and other emergency situations. The team includes dispatch operators, firefighters and police, and emergency nurses and physicians. Typically, two EMTs work together, driving specially equipped vehicles to the scene of an emergency. Sometimes specially trained police or firefighters with some EMT training (called "first responders") already will be on the scene.

Once the EMTs arrive they may have only a few seconds to size up the situation and make decisions about the patient's medical condition. At the same time they're trying to determine what is causing the medical emergency they're also trying to find out whether the patient has a pre-existing medical condition—for example, AIDS, epilepsy or diabetes—that will affect which treatment they should use.

Once they determine the nature of the problem, EMTs, following strict guidelines, are authorized to begin providing medical treatment. They may open a blocked airway, restore breathing, control bleeding, treat for shock, administer oxygen, immobilize fractures, bandage wounds, assist in childbirth, manage emotionally disturbed patients, treat and assist heart attack victims, give initial care to poison and burn victims, and use a machine known as an automated external defibrillator to help patients who are in cardiac arrest (having a heart attack).

But to go beyond this basic care, more training is required. An *EMT-intermediate* has been trained to administer fluids intravenously, use manual defibrillators (the "paddles" you may have seen on *ER* and other medical shows), give lifesaving shocks to a stopped heart, and use advanced techniques and equipment to clear the airway of a person who has stopped breathing.

The most advanced level of care is provided by *EMT-paramedics*. They may administer drugs orally and intravenously, interpret electrocardiograms (EKGs) and use other complex medical procedures.

## Job Outlook

**The field is expected to grow much faster than most, with a 44 percent increase, to 217,000 jobs, forecast through 2006. Some of the hike will come as communities change from volunteer to paid emergency services. There's also a lot of turnover in this job because it's a high-stress occupation.**

Sometimes EMTs have to provide medical care to victims who are trapped in a collapsed building or a wrecked automobile. They may radio for help from police and fire departments if such personnel aren't already on the scene.

Once they have made their assessment and started any medical treatment that is immediately needed, EMTs decide whether the patient should be taken to the hospital. If so, they immediately contact the emergency room by radio. During the trip, one EMT stays with the patient while the other drives. Along the way, they give the hospital's emergency team advance information on the patient's condition. In some cases, EMTs may help transport victims by helicopter to a trauma center.

Once they arrive at the hospital, EMTs quickly give patient information to the emergency room staff. They also fill the hospital in on treatment they've already provided.

## What's It Really Like?

EMTs face life-and-death challenges every single day. It's an exciting job, but it also can be stressful. "Even when I'm at home and hear sirens, I can feel my adrenaline going," says Jake, an EMT-paramedic.

Some of the stress comes from the fact that the job is physically dangerous. You may be exposed to many life-threatening diseases, including hepatitis-B and AIDS. Patients who have abused drugs or have serious mental illness may be violent. You may need to crawl into a collapsing building or pull a drowning person out of a swimming pool.

Stress also results from the people you can't save. It's hard to forget the battered wife who keeps returning to her abuser or the drug addict who won't go into treatment.

Of course, there also are enormous rewards. When people say, "You saved my life tonight," they really mean it. "Even if you only help one person in a 24-hour period, it makes it worth it," Jake says.

As an EMT, you may learn confidential information about the people you treat. A person with AIDS, for example, may not have told his employer or his family that he has the disease. The profession's code of ethics requires you to respect each individual's need for confidentiality.

The National Association of Emergency Medical Technicians summarizes the job's responsibilities this way: "To conserve life, to alleviate suffering, to promote health, to do no harm, and to encourage the quality and equal availability of emergency medical care."

## How Do I Get a Job and Advance?

You need formal training to become an EMT. It's offered by police, fire and health departments, and hospitals; and as non-degree coursework in colleges and universities. The National Registry of Emergency Medical Technicians registers emergency medical service providers at four levels: first responder, EMT-basic, EMT-intermediate and EMT-paramedic.

EMT-basic training is the minimum you'll need to qualify for a job as an EMT. It includes 110 to 120 hours of classroom work plus a 10-hour internship in a hospital emergency room. You'll combine instruction with hands-on practice in dealing with many emergencies: bleeding, fractures, cardiac arrest, airway obstruction and emergency childbirth. You'll learn how to use and care for basic lifesaving equipment, including backboards, suction devices, splints, oxygen delivery systems and stretchers.

When you complete your training and pass a written and performance exam, you can be registered as an EMT-basic. You'll need to keep your skills up and re-register, usually every two years.

Many EMTs continue their education and advance to EMT-intermediate or EMT-paramedic. EMT-intermediate requirements vary from state to state but typically include 35 to 55 additional hours of training and cover patient assessment, intravenous fluids and use of advanced airway devices. The EMT-paramedic training program generally takes 750 to 2,000 hours and combines clinical and field internships. This certification opens up access to higher-paying jobs.

## How Much Money Will I Make?

The average wage for an EMT with basic certification is $25,051. EMTs with paramedic certification earn an average of $30,407. Those employed by fire departments generally have higher salaries, while those hired by private ambulance services and hospitals typically get lower salaries.

## To Learn More

For information on training courses, registration and job opportunities, contact your state's emergency medical service director.

For general information, contact the National Association of Emergency Medical Technicians, 408 Monroe St., Clinton, MS 39056; (800) 34-NAEMT (346-2368) (www.naemt.org).

For certification information, contact the National Registry of Emergency Medical Technicians, Rocco V. Morando Building, 6610 Busch Blvd., P.O. Box 29233, Columbus, OH 43229; (614) 888-4484 (www.nremt.org).

### Did You Know?

**Parents sometimes name their baby after the EMT who helped with the delivery.**

# Health Information Technicians

**Are you detail oriented?**

**Do you like to work with computers?**

**Do you think you'd like a job that combines management, medicine and technology?**

Maybe you're allergic to an antibiotic. Perhaps you have a family history of diabetes. Or you may be recovering from knee surgery.

How does your doctor remember all that information about you and the hundreds of other patients he or she sees? By consulting your medical records. And who has primary responsibility for managing that information? The health information technician—also known as a specialist in health information management (HIM) and as a medical records specialist.

Health information technicians are valuable members of today's health care team. Doctors, nurses and other professionals respect them as authorities on medical data. By providing quality information to medical professionals, HIM specialists also contribute directly to quality patient care.

## What's It All About?

Every time health care workers see a patient, they record what they observed and the medical treatment the patient received. That includes patient information on symptoms and medical history, and the results of any tests (such as a blood test or a blood pressure check). X-rays, the doctor's diagnosis and the recommended treatment all are kept in this central place.

But who makes sure the information is recorded accurately? Who files it so the doctor or nurse can retrieve it the next time the patient comes into the office? And—increasingly important in this era of managed care—who sees to it that the insurance company gets the information it needs to pay the patient's bill? A health information technician. These individuals are responsible for managing the huge amount of medical data assembled on each patient to ensure quality care.

As an HIM specialist, you will have primary responsibility for organizing and evaluating medical records for completeness and accuracy. Your first responsibility is to make sure the medical chart is complete. If the doctor ordered a lab test, you need to see that the results are included with the chart. You also need to see that all forms are present and signed and that all necessary information is on a computer file. You may need to talk to a physician or another health care professional to get additional information. You need to be conscientious and detail oriented to do this work, since leaving out even one piece of information or entering some item incorrectly could affect a patient's health.

One of the primary responsibilities of an HIM specialist is to assign a code to each diagnosis and procedure. Using a classification manual, your own knowledge of disease procedures and computer software, you'll assign a patient to

## Job Outlook

The U.S. Department of Labor classifies health information technicians one of the 20 fastest growing occupations in the country. The number of jobs in the field is expected to increase by 51 percent, to 132,000, by 2006.

one of several hundred "diagnosis-related groups," or DRGs. It is essential that this coding is accurate—it's used by Medicare and insurance companies to decide whether the patient is covered and how much money they will reimburse.

Depending on your skills, interests and education, you may choose from a number of different HIM specialties. *Registered record administrators* (RRAs) are managers as well as information specialists. They interact with medical, financial and administration staff to interpret data for patient care, research, statistical reporting and planning. RRAs also protect the privacy of health information.

*Accredited record technicians* examine medical records for accuracy, report patient data for reimbursement and create disease registries for researchers.

*Certified coding specialists* are experts in classifying medical data. They assign a code to each diagnosis and procedure found in a patient's record. The codes are then reported to insurance companies or the government to pay for the patient's medical expenses.

Some HIM specialists are *tumor registrars*. They compile and maintain the records of patients who have cancer. Their work is used in research studies and by physicians as they plan the treatment of an individual patient.

## What's It Really Like?

In the past, most HIM specialists worked in hospitals and clinics. But today, a growing number of health-related organizations need accurate, up-to-date health information. There are opportunities for HIM specialists in health maintenance organizations, insurance companies, law firms, mental health facilities, doctors' offices, nursing homes, consulting firms, health data organizations and information system vendors. Public health departments also hire HIM specialists to supervise data collection from health care institutions and to help with research.

Your job responsibilities will vary depending on where you work. In a large hospital or nursing home, for example, you might specialize in one aspect of health information—for example, insurance billing. In a smaller facility your job will have more variety and more responsibility.

This is one of the few health care jobs that involves almost no direct patient care. "I have very little contact with patients," says Deanna, an HIM specialist who works for a group of pediatricians. "Usually if I hear from someone, it's because there's a problem with their insurance. It is satisfying when I can clear up their problem, but I do sometimes deal with angry people."

Most HIM specialists work a 40-hour week. In a hospital—where health information departments are open 24 hours a day, seven days a week—night and evening work is required.

HIM specialists spend their day in pleasant and comfortable offices. Because they spend much of their day at a computer, they may experience eye strain or muscle pain.

## How Do I Get a Job and Advance?

Most entry-level HIM specialists have at least an associate degree from a community or junior college. A growing number have a degree or specialized training in business, computer science or statistics.

There are more than 200 accredited health information specialist programs across the United States. You'll study medical terminology, anatomy and physiology, legal aspects of health information, coding and abstraction of data, statistics, database management, quality assurance methods and—especially—computers. You'll also complete a supervised internship in a hospital or other health care facility. You'll need to pass a certification examination offered by the American Health Information Management Association, which also offers some independent study programs in medical record technology and coding.

You can start preparing for an HIM career while you're still in high school. Take business, computer science, physiology, English, biology, chemistry and math—especially statistics. And take advantage of any health occupations courses your school may offer.

Most HIM specialists advance in one of two ways—by specializing or managing. Many senior health information technicians specialize in coding (particularly Medicare) or tumor registry. In a large HIM department, experienced technicians may become supervisors.

In some smaller health care facilities, a senior technician with accredited record technician credentials may become the director or assistant director of a health information department. In a larger institution, this job would go to a person with at least a bachelor's degree in health information administration.

## How Much Money Will I Make?

The average salary for HIM specialists is $31,200. Pay varies depending on experience, geographic location and education. Some in this field earn as much as $80,000 to $100,000.

## To Learn More

For additional information about careers in health information technology or a list of accredited programs, contact the American Health Information Management Association, 919 W. Michigan Ave., Suite 1400, Chicago, IL 60611; (312) 787-2672 (www.ahima.org).

### Did You Know?

**Fewer than half of all health information technicians work in hospitals.**

# Licensed Practical Nurses

**Are you good with people?**

**Are you caring and compassionate?**

**Can you follow precise orders and work under close supervision?**

## Job Outlook

The number of jobs in the field is expected to increase by 21 percent, to 848,000, by 2006. Nursing homes will be a particular growth area as the population ages. Job opportunities in home health care are expected to increase as well, with technological advances allowing more people to get the medical treatment they need in their own residences.

The patient in Room 416 needs an ice pack for a swollen ankle. The patient in Room 418 needs to have his blood pressure checked. And it's time for the diabetic patient in 419 to have her afternoon snack.

The licensed practical nurse (LPN) is the health care professional responsible for meeting all these patients' needs. If you want a job that gives you plenty of opportunity to work directly with patients, this may be the career for you.

### What's It All About?

LPNs give bedside care. Under the direction of doctors and registered nurses, they provide direct assistance to sick, injured, convalescent and disabled patients.

As an LPN you are responsible for taking a patient's vital signs—blood pressure, temperature, pulse and respiration. You'll record that information on the patient's medical chart so the doctor can keep track of the patient's progress.

LPNs provide other direct care to patients. They help patients with bathing, dressing and personal hygiene. They keep them comfortable. They may collect samples (of blood and urine, for example) for testing. They also may record food and liquid intake and output. In some states, LPNs may administer medications or start intravenous fluids. If an emergency occurs, the LPN should be able to perform CPR.

Because you are in so much direct contact with patients, you're also the one who is asked to observe how a patient reacts to medication or a treatment. "I noticed that an elderly lady had trouble swallowing after the doctor prescribed a new medication," says Jessica, an LPN in a nursing home. "I noted it on her chart and the doctor changed the medication. It's a good feeling to know you make a difference."

LPNs do make a difference. Sometimes the most important medical treatment they provide is their caring and concern. A kind word for a child about to undergo a bone marrow treatment, a smile for the senior citizen whose children never come to visit her or a pat on the shoulder for the heart patient who is taking his first steps after open-heart surgery may be as therapeutic as the medical care you administer.

### What's It Really Like?

About one-third of LPNs (32 percent) work in hospitals. Another sizable number (27 percent) work in nursing homes. The rest work in doctors' offices, clinics, home health care services or government agencies.

Wherever you work, you'll find this to be a job that's physically demanding. Because patients in hospitals and nursing homes need round-the-clock care, many LPNs can expect to work nights, weekends and holidays. You'll be on your feet for hours at a time. You may be exposed to caustic chemicals, radiation and infectious diseases such as AIDS and hepatitis-B. Back injuries can be a problem, since you may need to move heavy patients as you bathe them or otherwise help meet their personal needs.

It can be a stressful job. "It seems I never have the time I'd like to spend with my patients," Jessica says. Dealing with sick patients who may be confused, irrational or uncooperative also is a source of stress. LPNs should have a caring, sympathetic nature.

As the population ages the number of jobs in nursing homes is expected to increase rapidly—in fact, most new jobs for LPNs will be in this setting. If you work in a nursing home, you may assume additional responsibilities for patient care. You might be asked to evaluate a resident's needs and help develop his or her care plan. You also may supervise the care provided by nursing aides.

Home health care also will provide new job opportunities. Patients are sent home from the hospital much sooner than they were in the past. LPNs may provide continuing care for these patients between their visits to the doctor. They also may teach family members how to perform simple nursing tasks and might occasionally prepare meals.

## How Do I Get a Job and Advance?

If you want a medical career but don't want to spend years in school, think about becoming an LPN. "My family didn't have the money to send me to college," says Soo Khee. "I chose an LPN program because it gave me the chance to start supporting myself right away." Most training programs last about a year.

A high school diploma is usually required for acceptance into one of the approximately 1,100 state-approved LPN programs, but some programs will take people without a diploma. About 60 percent of LPNs received their training at a vocational or technical school. Most of the rest completed programs at community and junior colleges. Others underwent state-approved LPN training in programs offered in hospitals, colleges and universities, and high schools.

Most LPN programs last about a year and combine classroom study and supervised patient care. While training to become an LPN you'll study basic nursing concepts and patient care-related subjects, including anatomy, physiology, medical-surgical nursing, pediatrics, obstetrics, psychiatric nursing, administration of drugs, nutrition and first aid.

All states require LPNs to pass a licensing examination after completing their formal schooling.

There are limited advancement opportunities for LPNs, outside of locating similar positions in larger or more prestigious facilities where the pay is higher. Some LPNs may gain supervisory duties over nursing assistants and nurse's aides.

LPNs also might climb the career ladder by completing the additional education necessary to become a registered nurse (see separate description in this book).

## How Much Money Will I Make?

The average salary for a licensed practical nurse is $25,376. Factors affecting income include the facility's size, prestige and geographic location. The highest 10 percent of LPNs in salary earn about $35,000.

## To Learn More

For a list of state-approved training programs and information about practical nursing, contact the National League For Nursing, 61 Broadway, New York, NY 10006; (800) 669-1656 (www.nln.org).

Did You Know?

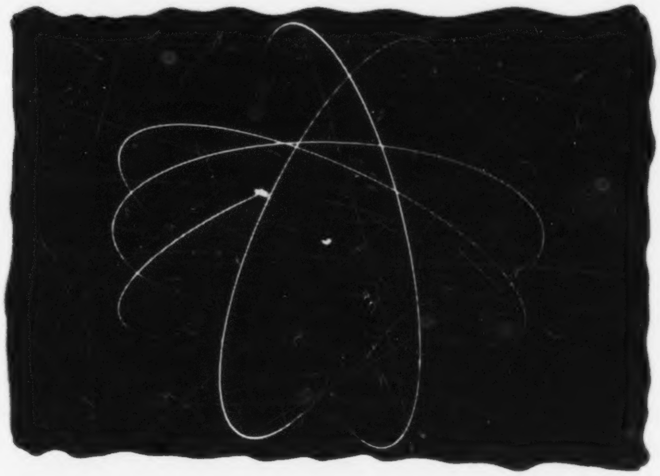
**In Texas and California, LPNs are called licensed vocational nurses.**

# Nuclear Medicine Technologists

**Could you handle developing compassionate relationships with patients who may be very ill or dying?**

**Do you cope well with emergencies?**

**Can you give clear instructions and explanations?**



## Job Outlook

**The number of jobs** is expected **to increase by** 13 percent, to **15,000, by** 2006. Some hospitals **are merging the nuclear** medicine **and the radiologic** technology **departments, so** opportunities will **be greatest for** technicians who **have knowledge** about both fields

Positron emission tomography. Anger gamma camera. SPECT imaging. No, these aren't terms from the latest sci fi movie. They're used in a high-tech branch of medicine known as nuclear medicine. Through a combination of radioactive drugs, computers and cutting-edge technology, nuclear medicine technologists and physicians are able to detect diseases that might otherwise go undiagnosed.

## What's It All About?

Nuclear medicine uses radioactive drugs to aid in the diagnosis and treatment of disease and injury. Bone scans used to detect cancer and cardiac stress tests to look for heart disease are two of the most common tests offered in nuclear medicine.

The nuclear medicine technologist administers small, safe amounts of radioactive drugs to a patient or a biological sample. Sensitive, specialized equipment is then used to detect concentrations of radioactivity in specific organs or in the sample and produce images doctors can use to diagnose the patient's illness. These images are further researched by using computer analysis or data processing techniques.

Here's how the tests work: Ionizing radiation, or radiopharmaceuticals, are attracted to specific organs, bones or tissues in the body. These radiopharmaceuticals produce emissions that can be detected by special cameras, which can produce a picture of the specific organ.

Usually, technologists prepare and administer the radiopharmaceuticals in an area called the hot lab, or radiopharmacy. The hot lab contains special equipment to reduce exposure to radioactivity as well as to measure the amount of radioactivity the technologist is handling. Although these diagnostic procedures use extremely small amounts of radiopharmaceuticals—comparable to, or often less than, that of a diagnostic X-ray—technologists follow strict safety standards when preparing radiopharmaceuticals so they can keep the radiation dose to both patients and workers to a minimum. They also are responsible for documenting the use of all the radioactivity that enters and leaves the department.

Most patient procedures involve the production of images requiring use of a sophisticated radiation-detection device called an Anger gamma camera. The most up-to-date, elaborate cameras may have two or three heads that circle or rotate around the patient while gaining an image. This technique is called SPECT imaging. The camera maps the radioactive drug in the patient's body and creates an image on photographic film. Later, a physician will interpret the test results.

Some patient studies do not result in images but in measurement of a radiopharmaceutical in an organ within the patient. This can be performed with an instrument called a scintillation probe. These counting procedures and the imaging procedures are called *in vivo* studies because they are performed within a living patient.

A few nuclear medicine technologists perform laboratory procedures on patient specimens such as blood or urine with extremely small amounts of radioactivity. These are called radioimmunoassays. Because these tests are performed in a test tube, they are called *in vitro*, or in the glass.

## What's It Really Like?

Nuclear medicine technologists perform a number of tasks in the areas of patient care, technical skills and administration. When caring for patients, they acquire knowledge of their medical histories to understand and relate illness and pending diagnostic procedures for therapy, instruct patients before and during procedures, evaluate the satisfactory preparation of patients before beginning a procedure, and recognize emergency patient conditions and initiate life-saving first aid when appropriate. Job responsibilities include instrumentation (proper maintenance of instruments), quality control, radiation safety, patient care and conducting diagnostic tests on patients.

If you enter this field, you'll always need to keep safety uppermost in your mind. You'll use your knowledge of radiation physics and safety regulations to limit patient and personnel exposure to radiation. You'll use a Geiger counter or a similar instrument to detect the presence of radioactivity. You'll wear a badge that measures radiation levels.

Record keeping also is essential. All technologists are responsible for evaluating and documenting that all the instrumentation used for patient procedures is functioning properly every day studies are performed. Administrative functions may include supervising other nuclear medicine technologists, students, laboratory assistants and other personnel; participating in procuring supplies and equipment; documenting laboratory operations; participating in departmental inspections conducted by various licensing, regulatory and accrediting agencies; and helping schedule patient examinations.

Nuclear medicine technologists usually work a 40-hour week, which may include evening or weekend work. Technologists who work in hospitals—and nine out of 10 do—also may have on-call duty.

A survey of nuclear medicine technologists found they like the opportunity to help people and the excellent job prospects in this profession. What they don't like are the pressures of working with the very sick and dying, the hazards of radiation, and standing for long periods of time.

## How Do I Get a Job and Advance?

Nuclear medicine technology programs range in length from one to four years and lead to a certificate, associate's degree or bachelor's degree. Certificate programs are generally offered in hospitals, associate's programs in community colleges and degree programs in four-year colleges and in universities.

Those already in a health profession—for example, radiologic technologists, medical technologists, registered nurses and ultrasound technologists—may enter the field after completing a one-year certificate program. Others interested in nuclear medicine technology have three options: a two-year certificate program, a two-year associate program or a four-year degree program. Courses include physical sciences, the biological effects of radiation exposure, radiation protection and procedures, the use of radiopharmaceuticals, imaging techniques and computer applications.

All nuclear medicine technologists must meet the minimum federal standards on the administration of radioactive drugs and the operation of radiation detection equipment. In addition, about half of all states require technologists to be licensed. Most employers prefer to hire certified or registered technologists.

Technologists may advance to supervisor and then to chief technologist, and finally to department administrator or director. Some specialize in a particular area—for example, nuclear cardiology.

## How Much Money Will I Make?

The average salary for nuclear medicine technologists is $36,100. Entry-level salaries range from $28,000 to $30,000.

## To Learn More

Additional information on a career as a nuclear medicine technologist is available from the Society of Nuclear Medicine-Technologist Section, 136 Madison Ave., New York, NY 10016 (www.snm.org) or the American Society of Radiologic Technologists, 15000 Central Ave., Albuquerque, NM 87123.

For a list of accredited programs in nuclear medicine technology, write to the Joint Review Committee on Educational Programs in Nuclear Medicine Technology, 1144 W. 3300 South, Salt Lake City, UT 84119.

Information on certification is available from the Nuclear Medicine Technology Certification Board, 2970 Clairmont Road, Suite 610, Atlanta, GA 30329 or the American Registry of Radiologic Technologists, 1255 Northland Drive, Mendota Heights, MN 55120.

### Did You Know?

**Nuclear medicine gives doctors the ability to detect cancer at far earlier stages than might otherwise be possible—and without surgery.**

# Occupational Therapists

**Are you comfortable working with people with disabilities?**

**Are you patient?**

**Do you like to help people learn to do things for themselves?**

Sandy, an occupational therapist, says, "People never know what I do for a living. Mostly, they think I help disabled people get jobs."

But in the case of occupational therapy, the word "occupation" means using purposeful activity as a way to prevent, reduce or overcome physical, social and emotional disabilities in people of all ages. As the American Occupational Therapy Association explains, "Occupational therapists work with people of all ages who, because of physical, developmental, social or emotional problems, need specialized assistance to lead independent, productive and satisfying lives."

The job is similar to that of physical therapists (see page 72). But, while occupational therapists address a gamut of physical, emotional and social limitations to help people function in mainstream society, physical therapists focus more narrowly on helping people overcome physical limitations.

## What's It All About?

Occupational therapists (or OTs) plan and direct programs designed to help mentally, emotionally and physically disabled patients become self-sufficient. These programs include educational, vocational and rehabilitative activities. The goal of occupational therapy is to enable patients to gain confidence, adapt to their particular handicap and use their time in ways that are personally rewarding.

OTs teach many types of activities to enhance or restore function. They instruct patients in relearning daily living routines such as dressing, eating, using the telephone, handling money and a variety of homemaking tasks. Often, OTs use special equipment—a special fork so patients can feed themselves, for example, or elastic shoelaces so they can tie their own shoes—that allow patients to perform everyday tasks. They also may employ "orthotic" devices, such as special braces that hold a weak ankle in place while a patient is learning to walk again.

An OT might help a patient with coordination and balance problems ride a bike or balance on a large rubber ball. A patient recovering from a stroke might get help cutting and folding paper. A patient might learn manual skills like typing or using power tools with assistance from an OT—not only to help restore physical mobility but also to prepare for future employment.

"After my stroke, I couldn't use my left hand—the one I write with," says Linda. "My occupational therapist helped me learn to write my name with my right hand even while we were working to get my left hand functioning again. She also taught me how to use an ATM machine—there was one right in her office —so I could practice withdrawing money from the bank."

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## Job Outlook

**A 66 percent** increase, to 95,000 **jobs, by** 2006.

As an OT, you'll work closely with both doctors and patients. You'll ask questions like, "Where do you want to be in six months?" Based on the patient's answers, you'll decide on a plan of therapy that best meets his or her needs. You'll have to take into consideration the type of developmental delay, injury or mental deficiency; what rehabilitation goals can realistically be met; and psychological needs the patient might develop because of his or her disability.

Computer technology is opening up many new doors for people with disabilities, and OTs are in the forefront of helping patients take advantage of these opportunities. In classrooms, for example, children with impaired speech due to cerebral palsy can now use computer technology to "speak" in class discussions. On the job, speech-recognition software can help a patient with a spinal cord injury hold a job involving writing.

## What's It Really Like?

OTs work in hospitals, rehabilitation centers, school systems, psychiatric facilities, convalescent homes and private practice. They may work in a clinic room with specific therapeutic tools or at the patient's bedside. OTs in private practice may go to clients' homes. Frequently, OTs work as members of a team of physicians, physical therapists, vocational counselors, nurses and others. A constant working condition, however, is the OT's contact with sick or injured people.

Here are some of the things OTs do:

- Take stock of a person's abilities—from physical, mental, emotional, social and environmental points of view. In other words, OTs take all aspects of a person's life and environment into consideration.
- Identify the obstacles a patient is facing and work with him or her to set goals to meet those challenges.
- Prevent circumstances that would further limit a person's abilities.
- Recommend activities and environments that promote health, independence and development of the patient's abilities.
- Provide assistive devices and technology that can overcome or compensate for some of a patient's limitations, and teach the patient to use these devices effectively.
- Consult with the patient, the family and caregivers every step of the way.

Schools are the second-largest employers of OTs (after hospitals), and this is an area where employment is expected to continue to grow. School OTs help children with disabilities develop the abilities—hand skills, eating, self-care, social skills and play/leisure skills—that will allow them to benefit from their educational program. OTs may advise teachers on how to set up classrooms so students can be more successful, or they may tell parents about exercises they can do at home to help their child's development.

As the school-age population increases, and as schools are required to provide more services for children with disabilities, this area offers excellent employment growth.

Other OTs work in mental health settings. They help people with mental retardation, or those who are mentally ill or emotionally disabled, learn to cope with daily life. In these settings, they also may work with patients who are dealing with alcoholism, drug abuse, depression, eating disorders or stress-related disorders.

The aging of the population also offers opportunities for employment. People over the age of 75 are likely to suffer from heart attacks, strokes or a variety of other disabling conditions. OTs will be needed to help these patients.

Some OTs, called industrial therapists, work with people whose ability to function on the job has been impaired. They arrange employment, plan work activities and evaluate patients' progress.

Most OTs work a 40-hour week, although almost one-third work part time. The job can be tiring, because therapists are on their feet much of the time. Hazards include back and muscle strain from moving patients.

## How Do I Get a Job and Advance?

You'll need a bachelor's degree in occupational therapy to get a job in this field. You'll study science—everything from anatomy and biology to kinesiology and zoology. You'll study psychology, child development and occupational therapy techniques. You'll also complete a six- to nine-month internship. Once you've graduated, you'll need to pass a licensing examination.

While you're still in high school, take as many science courses as you can, especially biology, chemistry, physics and health. If your school offers health occupations courses, take advantage of the opportunity. Paid or volunteer experience in the health care field also is helpful in getting admitted to a bachelor's degree program.

OTs may supervise other OTs, certified occupational assistants, occupational therapy aides or activity leaders. Some therapists teach in OT programs in colleges and universities.

## How Much Money Will I Make?

The average salary is $46,500. The top 10 percent in this field in salary earn more than $58,000.

## To Learn More

For additional information about the field, contact the American Occupational Therapy Association, 4720 Montgomery Lane, Bethesda, MD 20814-3425; (301) 652-2682 (www.aota.org).

### Did You Know?

**Occupational** therapists **sometimes** use the same **technology** that powers **actor Christopher** Reeve's **wheelchair—called** "sip **and puff"** because it relies **on small** changes in air **pressure to make** it possi**ble for** people with disabil**ities to make** phone calls, **turn** on lights or even use **the** microwave.

# Occupational Therapy Assistants and Aides

**Do you want a job that allows you to work directly with patients?**

**Are you comfortable around people with disabilities?**

**Can you work as part of a team?**

You're looking for a health care job but don't want to be bogged down in paperwork. Or you want to enter the health care field but don't want to be in college forever. You may be interested in a career as an occupational therapy assistant.

This is a job for people who want to spend their time directly with patients. "There's nothing like the feeling of pride you get when you see a patient who is able to stand on his own two feet," says one occupational therapy assistant.

## What's It All About?

Occupational therapy uses purposeful activity as a way to prevent, reduce or overcome physical, social and emotional disabilities in people of all ages. COTAs (certified occupational therapy assistants), as these aides often are known, help with the evaluation and treatment of individuals with injuries, illnesses, cognitive impairments, psychosocial dysfunctions, mental illness, developmental or learning disabilities, physical disabilities or other disorders or conditions.

"Our goal is always to help patients become as independent as they possibly can," says K.J., a COTA. "Sometimes that means we make adaptations to the patient's environment. Other times we help patients learn to compensate for their limitations."

For one patient that might mean learning the best way to move from a bed into a wheelchair. For another patient it might be learning how to use a special device to put on shoes and socks. For a third, it might involve stretching exercises to restore some use of a hand after an injury. The tasks are varied, depending on the patient's goals. "The job is as creative and diverse as you want it to be," K.J. says.

COTAs are part of a team of health care workers. In collaboration with the patient, the occupational therapist and, in some cases, the patient's family, COTAs develop a treatment plan for each patient. They are then responsible for working with the patient to make sure each activity is performed correctly. COTAs record their observations for use by the occupational therapist. They may, as well, offer suggestions on ways to alter the patient's treatment plan.

Under the supervision of occupational therapists, COTAs also may help design, develop, adapt or train patients in using assistive technology—anything from elastic shoelaces so they can tie their own shoes to a computer program that will power a wheelchair, turn lights on and off or start the microwave oven. They may help the occupational therapist design "orthotic" devices—special braces, for example, that hold a weak ankle in place while a patient is learning to walk again.

## Job Outlook

A 68 percent increase, to 28,000 jobs, by 2006 for occupational therapy assistants and aides.

## What's It Really Like?

An occupational therapy assistant is a "paraprofessional"—someone who works under the supervision of a certified occupational therapist. But COTAs still have lots of responsibility. "I think many people go into this field because they want the direct contact with patients and not so much administrative work," K.J. says.

More than one-third of COTAs work in hospitals, and a fourth work in nursing and personal care facilities. Most of the rest work in offices and clinics of occupational therapists and other health practitioners. A small number work in residential care facilities, outpatient rehabilitation centers and home health care services.

This is a "hands-on" occupation. COTAs spend most of their time with patients, doing everything from helping evaluate their situations, to training them in how to used special technology, to working with families. That direct contact with people is one of the most satisfying aspects of the job, people in the field say.

"I always feel I learn as much from my patients as I teach them," says K.J. "Senior citizens are so generous in offering words of wisdom—how they stayed married for 40 years, what they wish they'd done differently in raising their kids. You can learn a lot from patients if you're willing to listen."

Most COTAs work a 40-hour week and most work during the day. Some may work nights or weekends in order to accommodate a patient's schedule. COTAs need to be in good physical shape because they are on their feet for long periods of time and may be asked to help lift and move clients or equipment.

Ongoing changes in health care offer opportunities and challenges for COTAs. On the one hand, COTAs will be given more chances for direct patient care as the baby boom generation continues to age and health care facilities look for ways to contain costs. On the other hand, however, COTAs may end up assuming more of the administrative details that are required by insurance companies and managed health care plans.

## How Do I Get a Job and Advance?

You'll need an associate's degree or a certificate from an accredited community college or technical school. In the first year you'll learn basic medical terminology, anatomy and physiology. In the second year, you'll get more specifics about occupational therapy, including special courses in geriatrics (health care for senior citizens) and pediatrics (health care for children). You'll also need to complete supervised fieldwork. After you graduate, you'll need to pass a national certification exam.

While you're still in high school, take biology and any health courses your school offers. Volunteer work in a nursing home, an occupational or physical therapist's office or elsewhere in the health care field also can improve your chances of admission to a COTA program.

Most COTAs who want to advance go back to school for two to three years to become an occupational therapist. You also may advance along a COTA "career ladder"—taking more and more responsibility for patient care. Some COTAs are hired as activities directors in residential facilities.

## How Much Money Will I Make?

The average salary in the field is about $27,400.

## To Learn More

The American Occupational Therapy Association has a special section for COTAs. Contact the organization at 4720 Montgomery Lane, Bethesda, MD 20814-3425; (301) 652-2682 (www.aota.org).

### Did You Know?

**Occupational therapy assistants and aides constitute one of the 10 fastest-growing occupations in the country, according to the U.S. Department of Labor.**

# Physical and Corrective Therapy Assistants and Aides

**Do you have good interpersonal skills and like helping people?**

**Are you comfortable around people with disabilities and the elderly?**

**Can you work as part of a team?**

When one of her patients recently took his first steps after an accident, "I was almost as excited as I was the day my daughter took her first steps," says Erica, a physical therapy assistant.

That comment sums up the jobs of physical therapy assistants and aides. They work directly with patients, helping people with physical limitations reach their full potential.

## What's It All About?

Physical therapy involves helping people learn to use parts of the body. Physical therapy assistants and aides work under the supervision of physical therapists to restore, maintain and promote patients' overall physical fitness and health.

You'll work with a wide variety of people in this job. One day it might be an accident victim, the next a person recovering from a heart attack. From low back pain to cerebral palsy, many adverse medical conditions can be alleviated through physical therapy.

*Physical therapy assistants* do many things to help people relieve pain, improve their mobility, restore their muscle function and prevent or limit permanent physical disabilities. You might give one patient a paraffin bath, use electrical stimulation on another patient's muscles and massage a third patient. Hot and cold packs, traction and ultrasound are also ways to help patients increase their physical functioning.

Physical therapy assistants are "paraprofessionals," which means they must work under the supervision of a physical therapist. They have quite a bit of responsibility, however, and perform many tasks on their own. They are always responsible for keeping records and reporting the outcome of each treatment session to the supervising physical therapist.

*Physical therapy aides* have less training than physical therapy assistants and their duties are usually somewhat limited. They may be responsible for keeping the treatment area clean and organized. They may push patients to and from therapy in a wheelchair. They may provide physical support to a patient who needs it.

Both aides and assistants have some clerical responsibilities. They maintain patient records. They answer phones. They fill out insurance forms. Most important, they keep accurate records about each patient's progress so the physical therapist is always up to date.

## What's It Really Like?

You'll spend most of your time in direct patient contact. Whether you're giving manual therapy—exercises to strengthen specific muscles or stretch a particular part of the body—or helping

## Job Outlook

**A 76 percent increase,** to 151,000 **jobs by 2006.** The U.S. **Department of Labor** predicts that this **occupation will be** one of the **fastest-growing** occupations **through the year** 2006.

a stroke patient climb up and down steps, most of your time is spent in hands-on activities.

"I like the direct patient contact," Erica says. "I'm someone who really likes people. In this job, I am constantly getting to know people with interesting stories to tell."

Still, that direct patient contact also can be a source of stress or sadness. Some patients make only limited progress. Others suffer from debilitating conditions that may eventually leave them paralyzed or take their lives.

Two-thirds of all physical therapy assistants and aides work in hospitals or in the offices of physical therapists. Others work in outpatient rehabilitation centers, nursing homes, physicians' offices and clinics, corporate or industrial health centers, sports facilities, research institutions, home health agencies, schools, pediatric centers and colleges and universities. Those who specialize in sports physical therapy may work part of the time on the sidelines of sporting events.

Most physical therapy assistants and aides work a 40-hour week. Many clinics and physical therapy offices are open weekends and evenings, however, to provide more convenience to their patients.

Standing, kneeling, stooping and lifting are all parts of the job. You need a moderate degree of physical strength so you can help patients with their treatment.

Ongoing changes in health care offer opportunities for physical therapy assistants. After patients are evaluated and a treatment plan is designed by a physical therapist, a physical therapy assistant can provide much of that treatment.

## How Do I Get a Job and Advance?

Physical therapy assistants usually have an associate's degree from an accredited physical therapist assistant program. These programs are offered in colleges and universities, medical schools, vocational-technical schools and community colleges.

These two-year programs include academic study in such areas as algebra, anatomy, physiology, biology, chemistry and psychology. They also include clinical experience, which employers typically expect. Students must be certified in CPR and first aid. Currently, more than half of all states require physical therapist assistants to be licensed, registered or certified—which usually involves completing an accredited program and passing an exam.

Admission to physical therapy assistant programs is highly competitive, and it's not unusual to be placed on a waiting list. If you think you're interested in this field, take as many science classes as you can while you're still in high school. Also, try to get some experience working with people with disabilities.

Physical therapy aides usually must have a high school diploma, strong interpersonal skills and a desire to help people in need. Most aides learn on the job.

Aides who want to advance will usually have to enroll in a physical therapy assistant program. Physical therapy assistants may advance by taking additional training to become a physical therapist.

## How Much Money Will I Make?

The average salary for physical therapy assistants is about $24,000. Physical therapy assistants in private practice earn about $30,000. Physical therapy aides earn about $16,000.

## To Learn More

For more information on a career as a physical therapist or aide, and for a list of schools offering accredited programs, contact the American Physical Therapy Association, 1111 N. Fairfax St., Alexandria, VA 22314 (www.apta.org).

For information on what's required to become a physical therapy assistant in your state, contact the state's licensure board.

### Did You Know?

**Population trends in the United States indicate that, by the year 2030, there will be more people over age 65 than under age 18. An aging population offers many job opportunities for people in physical therapy careers, since older people are more likely to suffer from strokes, heart attacks and other debilitating conditions.**

# Physical Therapists

**Do you want a "hands-on" job that helps people reach their potential?**

**Are you comfortable around people with disabilities?**

**Are you physically fit?**

A woman learning to walk again after a stroke ... a preschooler with cerebral palsy ... a construction worker with a back injury ... an Olympic athlete recovering from knee surgery ... a senior citizen with arthritis. What do these diverse people have in common? All are probably working with a physical therapist.

This fast-growing career offers lots of variety. Whether you want to work with infants or the elderly, in hospitals, schools or businesses, there's an opportunity to use your skills as a physical therapist.

## What's It All About?

Physical therapists help people overcome physical limitations—with the goal of restoring, maintaining and promoting fitness and health. The job is similar to that of occupational therapists (see page 66), but the latter job focuses more broadly on helping people overcome a gamut of physical, emotional and social limitations to better function in mainstream society.

Physical therapists work with accident victims and individuals with disabling conditions that range from low back pain to heart disease to brain injuries to cerebral palsy. As a physical therapist, you'll help relieve people's pain, improve their mobility, restore their muscle function and prevent or limit permanent physical disabilities.

You'll help your patients meet their health goals. These will be different for each patient. For one person, success might be defined as learning to walk without a brace. For another, success might mean being able to play basketball on a nationally ranked team.

Treatment plans usually include manual therapy—exercises to strengthen specific muscles or stretch a particular part of the body. You'll probably work with a patient two or three times a week for at least a month. Some patients will need therapy for years or even throughout their lives. Others will need only short-term therapy and will then be able to carry on by themselves.

Many physical therapists work in schools, helping children with disabilities. "I work for a school system," says Marge. "I enjoy the regular hours and the chance to establish long-term relationships with children and their families." As medical science advances and preserves the lives of more and more children with serious physical disabilities, the field of pediatric physical therapy is expected to grow.

Patients who are learning to use artificial limbs after an amputation will work with physical therapists to get maximum use from the devices. Physical therapists also can help patients who are learning to use wheelchairs, leg braces or other physical aids.

The fitness boom has led to new

## Job Outlook

Physical therapy is one of the fastest-growing occupations. The number of jobs in the field is expected to increase 70 percent, to 196,000, by 2006. As the baby boom generation ages, physical therapists will be in demand to treat patients afflicted with heart disease, stroke, arthritis and other serious ailments.

opportunities for physical therapists. As people step up their level of fitness, they sometimes cause injuries that require treatment. They also want to learn how to prevent injuries by following a conditioning program.

If you enjoy travel, you might go to work for what is called a traveling company. You'll get sent around the country on short-term assignments, wherever there's a need.

Physical therapists may work with:

- premature infants
- pediatric patients
- people with sports or traumatic injuries
- adults with back or neck injuries
- people with birth or genetic defects
- stroke victims
- amputees
- dancers and performing artists
- athletes
- burn and wound patients
- people with muscular sclerosis, Parkinson's disease or brain injuries
- patients recovering from major surgery
- senior citizens

Some physical therapists enjoy working with a wide variety of patients. Others choose to specialize in a particular field, whether it is working with children, senior citizens or athletes.

## What's It Really Like?

Physical therapy is, quite literally, a hands-on job. Physical therapists have to stoop, kneel, crouch, lift and stand for long periods of time. They also move heavy equipment and lift patients or help them turn, stand or walk.

With one patient, you may design a set of exercises to do at home. With another patient, you might use traction or massage to help stimulate muscles. Another patient's injury might require electrical stimulation, hot packs, cold compresses or ultrasound to relieve pain and reduce swelling. As a physical therapist, you need to know about the latest advances in medical technology, since a given patient may require anything from laser therapy to hydrotherapy to electrotherapy.

Physical therapists work as part of a patient's health care team. Depending on a patient's needs, they may be asked to work with doctors, occupational therapists, rehabilitation nurses, social workers, speech pathologists, dentists or audiologists.

Though a large number of physical therapists work in hospitals, today about 70 percent are employed in private physical therapy offices, community health centers, schools, corporate health centers, sports facilities, home health care agencies, and colleges and universities.

One important part of the job is keeping accurate records. You need this documentation not only to plan future treatment but also to provide to insurance companies, who will reimburse you for your services.

Physical therapists need good interpersonal skills. Whether you're encouraging a patient to repeat an exercise just one more time or teaching a family member how to attach an artificial limb, you'll need the ability to explain things clearly and motivate patients and their families. "I've worked with several physical therapists since my stroke," says Linda. "The ones who are most helpful are the ones who emphasize what I can do, rather than what I can't."

## How Do I Get a Job and Advance?

Physical therapists must have at least a bachelor's degree. By 2001, all accredited physical therapy programs will be at the master's degree level.

The coursework for becoming a physical therapist is heavy on math and sciences. In addition to basic sciences like biology, chemistry and anatomy, you'll study biomechanics, neuroanatomy, therapeutic procedures, exercise science and exercise physiology. You'll dissect a cadaver. Besides your classroom instruction, you'll also take part in supervised clinical training.

Although the number of colleges and universities offering physical therapy programs is increasing, there are still more people who want to enter the field than can be accepted into a training program. If you are interested in physical therapy, you need to get good grades while taking a challenging high school curriculum, including as much science as you can. You also should enroll in a health occupations program if your school or district offers one, or volunteer to work in a hospital or with a physical therapist so you can get an idea of what's involved—and because many physical therapy programs require you to have completed volunteer work before you can be admitted.

After you complete your training, you will need to be licensed in the state where you plan to practice. All states require physical therapists to pass a licensing exam. Many states also require physical therapists to continue their education after they are licensed.

Because physical therapists deal with such a wide range of people, if you're interested in physical therapy it should be possible to find a job that matches your interests. You might spend part of your career working in a hospital, then work for a corporation or go into private practice.

## How Much Money Will I Make?

The average salary of full-time physical therapists is $48,000. About one in four people in the profession works part time.

## To Learn More

For information on a career as a physical therapist and a list of physical therapy programs, contact the American Physical Therapy Association, 1111 N. Fairfax St., Alexandria, VA 22314 (www.apta.org).

### Did You Know?

**Physical therapists are increasingly being asked to help prevent injuries even more than treat them. They work with athletes to teach them how to improve their performance without unnecessarily adding to stress and strain on their bodies, for instance.**

# Physician Assistants

**Do you want a job that will give you plenty of responsibility?**

**Do you enjoy being part of a team?**

**Do you want to work directly with patients?**

About 30 years ago, doctors recognized that there weren't always enough primary care physicians to meet growing demands for health care. For instance, in some small or rural communities, a doctor might visit only once or twice a week.

At the same time, medics who had served in Vietnam were returning to this country with no opportunities to use the valuable medical skills they'd gained. The physician assistant field was created out of those two needs. Today, physician assistants (PAs) are trained and licensed to practice medicine and provide health care services with supervision by physicians.

## What's It All About?

"I'm not a doctor," says Richard, a PA, "but I have the training to do many of the same things doctors do." PAs take medical histories, examine patients, and order and interpret laboratory tests and X-rays. They are trained to diagnose and treat illnesses. They assist in surgery, treat minor injuries and counsel patients. They record patient progress, instruct and counsel patients, and order or carry out therapy. In most states, PAs can even prescribe or dispense medicine.

Sometimes PAs have management responsibilities. In a clinic or medical center, they may order medical or lab equipment. Others may supervise medical technicians or medical assistants.

Today, over half of all physician assistants practice what is known as "primary care medicine"—family medicine, internal medicine, pediatrics, and obstetrics and gynecology. Others work in specialty areas such as emergency medicine, orthopedics and geriatrics. Two-thirds work in offices and clinics of doctors and other health practitioners, and another 20 percent work in hospitals. The rest are employed in public health clinics, nursing homes, prisons, home health care agencies and by the U.S. Department of Veterans Affairs.

PAs have a lot of responsibility but they always need to work closely with doctors. Physicians usually handle the more complicated medical cases. An important part of the training to become a physician assistant is learning when you've reached the limits of what you know and need to refer the case to a doctor. "You have to be able to talk about your cases with a doctor, even if it's only by phone," says Richard. "At some point, the doctor has to co-sign the chart."

## What's It Really Like?

"What you do depends a lot on where you work," says Sherry, who has held a number of different jobs as a PA. "In an emergency room, you're likely to have to put a splint or a cast on a fractured bone. In surgery, you might assist the

### Job Outlook

The number of jobs for physician assistants is expected to increase much faster than the average growth rate for all jobs. The number of positions is expected to increase by 46 percent, to 93,000, by 2006.

surgeon." If you're looking for a job with a lot of variety, this might be right for you.

Some PAs make house calls or visit patients in the hospital. Later, they'll tell the physician what they learned.

As a PA, you'll have the same kind of schedule as a doctor. If you're working in a hospital, that means you should expect to work some nights and weekends. If you're working with a doctor in private practice, you'll probably be on call some of the time. The job can be physically demanding—PAs who work in surgery can stand for long periods of time. Others may walk several miles a day as they move through the halls of a large hospital.

About one-third of PAs provide health care in communities with fewer than 50,000 residents. In many of these communities, doctors may be in short supply. For example, in some rural clinics, a doctor visits only one or two days a week. The rest of the time health care is provided by a PA.

In the future, "telemedicine"—the use of technology to allow interactive consultations between physicians and PAs over long distances—is likely to expand job opportunities for physician assistants. Via a telephone, video and computer linkup, PAs will be able to talk to specialists who may be hundreds or even thousands of miles away. That will mean better access to health care for all people, regardless of where they live.

## How Do I Get a Job and Advance?

If you think you might want to be a PA, try to get some medical experience while you're still in high school. If your school or system offers a health occupations program, take advantage of it.

"Doctors and PAs do some kinds of patient care," says Sherry, "while nurses do different things. Having some experience in a hospital or a clinic will help you decide if you really want to be a PA and not a doctor or a nurse."

Almost all states require physician assistants to complete a formal training program. The typical program is 24 to 25 months long, and admission requirements include at least two years of college and some health care experience. Most people admitted to a physician assistant training program have a college degree and three or four years of experience in health care.

While you're in training, you'll study basic medical science. You'll also get clinical experience in internal medicine, family medicine, surgery, pediatrics, obstetrics and gynecology, emergency medicine and geriatrics. Some PAs get additional education and training so they can practice in a specialty area, such as surgery or emergency medicine. When you graduate, you'll be required to take a national certification exam.

Your education won't stop after you graduate, though. Physician assistants are required to continue to update their medical knowledge—taking at least 100 hours of continuing education every two years. And every six years you'll have to pass a recertification exam.

Long-term job opportunities for physician assistants are excellent, as more Americans need health care, and as insurance companies and health maintenance organizations continue to look for ways to control costs.

## How Much Money Will I Make?

The average income of physician assistants is $61,021. It varies by specialty, practice setting, geographical location and years of experience.

## To Learn More

For information on becoming a physician assistant, contact the American Academy of Physician Assistants Information Center, 950 N. Washington St., Alexandria, VA 22314 (www.aapa.org). The same organization can provide you a list of accredited programs that train people to become PAs.

For a description of the Physician Assistant National Certifying Examination, write to the National Commission on Certification of Physician Assistants Inc., 6849-B Peachtree Dunwoody Road, Atlanta, GA 30328.

### Did You Know?

**The person who wrote the prescription for your pills might not be a doctor—in 41 states and the District of Columbia, physician assistants can prescribe medicine.**

# Radiologic Technologists

**Are you intrigued by high-tech equipment?**

**Are you safety conscious?**

**Are you good with people, especially those who may be nervous or worried?**

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Today, Judy got to tell a happy couple that the baby they're going to have will be a boy. Maria operated machinery that helps cure cancer patients without the need for disfiguring surgery. And Dexter used high-tech equipment that detected a tiny stress fracture that has kept an Olympic skater out of competition.

All these people are radiologic technologists. They operate sophisticated equipment to help physicians, dentists and other health care practitioners diagnose and treat patients.

## What's It All About?

You probably had an X-ray when you went to the dentist or when you fell out of a tree and broke your arm. Today, medical science has found many ways to use ionizing radiation and other imaging techniques to detect disease or injury in the body. In some cases, radiologic technologists also treat diseases such as cancer.

There are several specialties within this profession. *Radiographers* use radiation to produce images of the tissues, organs, bones and vessels of the body. The technologist passes a beam of X-rays through the patient's body onto a piece of photographic film. The bones absorb more of the rays than do the muscles or other organs, so the bones cast the sharpest shadows on the film.

Sometimes doctors or technologists introduce a harmless substance into the body to make a specific organ stand out more clearly. Before making an intestinal X-ray, for example, the patient may be asked to swallow a solution of barium sulfate, a substance that absorbs X-rays, thus making the intestines show up clearly on the film. Once the image is made, technologists remove the film and develop it.

*CT technologists* operate a computerized tomography scanner, which produces a cross-section view of a patient.

*Mammographers* use radiation to detect breast disease. They also teach women about breast health.

*Cardiovascular-interventional technologists* use radiation to produce images that aid in the diagnosis and treatment of diseases of the blood vessels. These images also are used in detecting abnormalities, including coronary artery disease, and they aid heart surgeons during angioplasty, a surgical technique designed to open blocked blood vessels that supply blood to the heart.

*Sonographers* use high-frequency sound waves to produce images of internal structures. The equipment then collects reflect echoes to form an image that is viewed on the screen and may be recorded on videotape. Because sonograms do not damage a developing fetus, they often are used when obstetricians want to check on the health of a developing infant. Sonography also is

## Job Outlook

A 29 percent increase, to 224,000 jobs, by 2006. Job opportunities in some areas of this field are better than in others, however. For example, many hospitals are merging their radiology and nuclear medicine technology departments as a way of reducing costs. As a result, job growth in radiology will be slower than expected, and those with some additional training in nuclear medicine technology will have the best job prospects.

used with other kinds of diagnoses. Sonographers may specialize in neurosonography (the brain); echocardiography (the heart); or vascular (blood flows), abdominal (liver, kidneys, spleen and pancreas) or ophthamology (eye) diagnoses.

*Magnetic resonance imaging (MRI) technologists* are the newest specialty in the profession. They use radio waves, magnetic fields and a computer to produce images of body tissues.

*Radiation therapy technologists* treat various kinds of cancers. They position patients under the equipment so they can direct the radiation precisely to the tumor. Large doses of radiation kill cells, which is good if the radiation is directed at a cancer tumor. But technologists must be very accurate so the radiation is directed to the cancer and not to a healthy part of the body.

## What's It Really Like?

In this job you need to know a lot about high-tech equipment. But you need to know a lot about people, too. You're the one responsible for keeping the diagnostic equipment—which may cost hundreds of thousands of dollars—in operation. You're also the one who deals directly with patients. You may need to calm the fear of a patient who is nervous about being confined in a small space while having an MRI. Or you may need to explain the side effects of radiation—which may include nausea, hair loss and skin irritation—to a cancer patient undergoing radiation therapy.

Safety is a primary responsibility of a radiologic technologist. Radiation can cause biological, chemical and physical changes, and can even damage or destroy living tissue. You'll use protective gear—lead aprons, gloves and other shielding devices—to protect both yourself and your patients from exposure to radiation. You'll also wear a badge to measure the radiation levels in the radiation area.

Most radiologic technologists—more than half—work in hospitals. Usually they do their work in a lab, although some procedures can be performed at a patient's bedside.

Other radiologic technologists work in physicians' offices and clinics, including diagnostic imaging centers. Some drive large vans equipped with sophisticated equipment. For example, in one city, a team of mammographers drive a "mammovan" to work sites so women can get a mammogram without coming to a hospital.

The work usually involves being on your feet for long periods of time. You also may need to lift or move patients.

The rewards of the profession come when you are able to help a patient detect a condition in time for it to be treated successfully. "A mammographer saved my life," says Jane, a cancer survivor. "She found a malignant tumor during a routine mammogram in time for me to be treated successfully."

There are sad and difficult parts to the job, too. If you're a radiation therapist, you may spend many weeks treating a cancer patient who does not survive. If you're a sonographer, you may see that an eagerly awaited infant has a potentially life-threatening medical condition.

## How Do I Get a Job and Advance?

Hospitals, colleges and universities, vocational-technical schools and armed forces hospitals all offer training programs for radiologic technologists. Most of these are two-year certificate programs, although there are some one-year programs, and four-year programs that award a bachelor's degree.

You'll study anatomy and physiology, patient care procedures, radiation physics, radiation protection, principles of imaging, medical terminology, positioning of patients, medical ethics, radiobiology and pathology. Once you have the basics you can specialize in radiography, radiation therapy or diagnostic medical sonography. After you're hired, you'll need to complete at least 24 hours of continuing education every two years (sonographers are required to complete 30 hours of education every three years).

While you're in high school, take courses in mathematics, physics, chemistry and biology. Any experience you can get in a medical setting—such as through a health occupations program—also will be helpful.

With experience and additional training, you may become a specialist, performing CT scanning, ultrasound, angiography and magnetic resonance imaging. Those interested in working with cancer patients can specialize as medical radiation dosimetrists—working with oncologists and health physicists to develop treatment plans for cancer patients. Experienced technologists, especially those with advanced degrees, may be promoted to supervisor or chief radiologic technologist.

## How Much Money Will I Make?

The average salary for a full-time radiologic technologist is about $29,000. Radiation therapy technologists ($37,300) and ultrasound technologists ($36,100) earn more.

## To Learn More

For information on a career as a radiologic technologist, contact the American Society of Radiologic Technologists, 15000 Central Ave. SE, Albuquerque, NM 87123 (www.asrt.org). For the current list of accredited education programs in radiography and radiation therapy technology, write to the Joint Review Committee on Education in Radiologic Technology, 20 N. Wacker Drive, Suite 600, Chicago, IL 60606.

### Did You Know?

**X-rays were not discovered until 1895 by William Roentgen, a German physicist. He called them X-rays because he didn't know what they were, and X is the scientific symbol for the unknown.**

# Recreational Therapists

**Are you comfortable around people with mental, physical or emotional difficulties?**

**Are you patient, tactful and persuasive?**

**Are you flexible?**

A nursing home resident has been withdrawn and depressed since the death of her husband several months ago. Today, however, she's been encouraged to participate in a game of Scrabble—an activity she has always enjoyed. A recreational therapist has organized the game as a way to help her come out of her shell.

A 19-year-old with mental retardation will be graduating from high school and moving into a group home next year. Working with a recreational therapist, he learns how to take the bus to a nearby pool so he'll be able to continue the swimming he has always loved.

These are just two examples of how recreational therapists can help patients. People with a wide range of physical and mental disabilities can benefit from the work of these health professionals.

## What's It All About?

Recreational therapists work with people who have mental, physical or emotional disabilities. As a recreational therapist, you'll use your knowledge of and training in the workings of the human body to plan a wide range of recreational activities—from arts and crafts, to games and sports, to animals, to music, to community outings—that are designed to help treat or maintain your patients' physical or emotional health.

For instance, you might use a recreational activity like fishing to help a patient who is learning to deal with paralysis of the right side. By participating in an activity he enjoys, the patient may be motivated to learn to use his left hand and arm. A patient whose mental illness has isolated her from other people may be encouraged to join in a card game.

You might build on one patient's love of baseball to strengthen muscles weakened by disease. You might teach another how to use relaxation techniques to reduce stress and tension. A third client might need to be encouraged to take part in a group activity following hospitalization for depression.

Recreational therapy is a job that requires lots of imagination and ingenuity. You need to figure out which activities are most likely to appeal to individual clients—then decide how you can adapt those activities to meet the client's particular physical or mental disabilities. If one approach doesn't work, you must be creative enough to try something else.

## What's It Really Like?

Recreational therapists usually work as part of a medical team that also may include physicians, nurses, physical and occupational therapists, social workers and psychologists. They assess an individual patient's need by examining medical records, consulting with the

## Job Outlook

A 21 percent increase, to 46,000 jobs, by 2006. A growing number of positions will be in hospital-based adult day care or outpatient programs. Residential treatment programs for people with mental health issues or those recovering from substance abuse also are expected to provide many new jobs.

other members of the health care team and meeting with patients and their families. Based on your evaluation, you'll draw up a treatment plan that takes into account the patient's needs, abilities and interests.

Nearly half of all recreational therapists—42 percent—work in hospitals, and another 38 percent work in nursing homes. Others work in adult day care programs, correctional facilities, community mental health centers, community programs for people with disabilities and substance abuse centers. About one in four recreational therapists is self-employed, usually working on contract to develop and oversee programs for one or more long-term-care facilities or community agencies.

Some recreational therapists work in schools, helping students with disabilities make the transition from school to adult life. Recreational therapists are there to help them learn about leisure-time activities they can enjoy after they graduate. Their primary job, however, is to teach students with disabilities how to become active members of the community after high school.

Not surprisingly, you must be physically fit to be a recreational therapist. You may be required to lift heavy equipment or participate in active recreational programs with patients. Good physical coordination will help you demonstrate the activities you've planned.

You'll need to keep accurate records of your patients' participation in activities, as well as the progress they are making. Other medical staff members will use these records to monitor the patient's progress and decide on future treatment. Records also will be used for billing.

Recreational therapy isn't an office job. Although you'll do some of your work in an activity room, you'll also get out into the community. You may be called on to take clients to parks, playgrounds, swimming pools, restaurants or theaters.

You must be comfortable around people who have disabilities or are ill. Serving people who have a variety of physical and mental challenges also requires a lot of patience. But you'll have the satisfaction of knowing you've improved the quality of your patients' lives.

Depending on where you're working, you may face situations that are tough to handle. Nancy, a recreational therapist in a children's cancer ward, says, "These are very, very sick children. When they come here, they're using their last option to eradicate their disease. Working with them is so rewarding, but of course we have some situations which are terribly sad."

## How Do I Get a Job and Advance?

You need a bachelor's degree in therapeutic recreation to get an entry-level job in a clinical setting like a hospital or community center. Most employers want to hire people who are certified as therapeutic recreation specialists. That involves passing a certification examination and completing an internship of at least 360 hours.

You'll study anatomy, physiology, abnormal psychology and characteristics of illnesses and disabilities. You'll learn about working as part of a team, as well as how to assess patients and refer them to other medical professionals. You'll learn about the technology and the assistive devices you can use to meet patients' specific needs.

Advancement is chiefly to a supervisory or administrative position. Some recreational therapists teach, conduct research or consult with private clients.

For a job as activity director of a nursing home, you'll need a two-year associate degree in recreational therapy, as well as training in art, music or drama therapy.

While you're in high school, you can prepare for a career in recreational therapy by participating in a health occupations program if available; and through vocational student organizations, sports and other activities that stress things like teamwork and building your social skills. Studying psychology and anatomy is also helpful. Volunteer work that brings you into contact with people with disabilities is great preparation, too.

## How Much Money Will I Make?

The average salary of recreational therapists is about $33,000. Those who work as administrators or supervisors can expect to earn significantly more—about $42,000 on average.

## To Learn More

For information on careers and academic programs in recreational therapy, contact the American Therapeutic Recreation Association, P.O. Box 15215, Hattiesburg, MS 39402 (www.atratr.org) or the National Therapeutic Recreation Society, 22377 Belmont Ridge Road, Ashburn, VA 20148 (NTRSNRPA@aol.com).

Information on certification for recreational therapists is available from the National Council for Therapeutic Recreation Certification, P.O. Box 479, Thiells, NY 10984.

### Did You Know?

Recreational therapists should not be confused with recreation workers, who also organize recreational activities but aren't required to complete the same level of training, and who primarily organize leisure activities for people who are not disabled.

# Registered Nurses

**Are you compassionate and caring?**

**Are you attentive to the needs of others?**

**Would you describe yourself as a "people person?"**

*"I'm a patient advocate."*

That's how Phil, a registered nurse (RN) specializing in cardiac care, describes his job.

Like many other RNs, he works to promote health, prevent disease and help patients cope with illness. In addition to patient advocacy, RNs are health educators for patients, families and communities.

There are two main types of nurses: licensed practical nurses (LPNs; see the separate description on page 62) and, at a higher level, RNs. Many people start out at the first level and eventually advance to the second.

## What's It All About?

RNs spend much of their time providing direct care to patients. They observe, assess and record symptoms, reactions and progress. They assist physicians during treatments and examinations. They help patients during their recovery and convalescence.

RNs are licensed to make many critical decisions about care on their own. They can administer medication. They can start intravenous fluids. They develop and manage nursing care plans and help individuals take steps to improve or maintain their health. They also supervise LPNs and nursing aides.

From the family interaction of home health care to the fast-paced unpredictability of the emergency room, the career choices offered within the nursing profession are many. The following are just some of the areas in which nurses may specialize.

*Family nursing* involves working with every age range, from neonatal to geriatrics. Many family nurses go on to become nurse practitioners or nurse midwives.

*Hospital nursing* includes a wide range of specialties:

- Emergency room nursing. You'll treat patients who come in on their own or who are brought in by emergency medical technicians. They may have problems that range from a gunshot wound to a heart attack to a broken bone.
- Intensive care nursing. You'll treat patients in critical condition who require one-on-one care.
- Medical/surgical nursing. You'll treat patients who are recovering from surgery or who have a variety of illnesses.
- Obstetrics/gynecology nursing. You'll work on the maternity ward, where women deliver their babies, and in the nursery for newborn infants.
- Operating room (OR) nursing. OR nurses are part of a team that includes surgeons and anesthetists.
- Outpatient department or clinic nursing. You'll see patients who are not sick enough to be admitted to the hos-

## Job Outlook

**Registered** nursing is one of the **five fastest**-growing health care **occupations**, according to the U.S. **Department** of Labor. The number **of jobs in** the field is expected to **increase** by nearly 21 percent, to **2.3 million** jobs, by 2006. Most **jobs will** be created in the field of **home** health care.

pital. After treatment they return home. Today, more and more medical procedures are done on an outpatient basis.

- Psychiatric ward nursing. You'll deal with patients who have emotional illnesses that can result in everything from eating disorders to attempted suicide.

*Public health nursing* involves working for government and private agencies and clinics, schools and retirement communities. Public health nurses aim to improve the overall health of communities. In addition to arranging immunizations and health screenings, they often work with community leaders, teachers, parents and physicians in community health education.

*Occupational health or industrial nursing* involves providing on-the-job health care. These nurses may treat minor injuries, provide emergency care, prepare accident reports and work with employers to identify health problems at the work site.

## What's It Really Like?

What you do depends on where you work. If you're in a hospital you'll probably be assigned to one area, such as surgery, maternity or emergency room nursing. You'll provide bedside nursing care and carry out medical regiments.

If you're a public health nurse you'll spend a lot of time teaching people about disease prevention, nutrition, child care and home care of people with illnesses and disabilities. If you work in a doctor's office, you'll help with examinations, administer injections and medications, dress wounds and incisions, assist with minor surgery and maintain records.

Although your primary job is patient care, you'll spend a lot of time in record keeping. For example, in a hospital, every order for every patient has to be acknowledged and charted by an RN. "I don't get lunch—ever," says Phil. "Paperwork is necessary, but it's the part of the job I like the least."

You're on your feet nearly all the time. You may be exposed to infectious diseases, including hepatitis and AIDS. You also may be exposed to radiation, chemicals used for sterilizing medical instruments and other hazards.

Nurses should be caring and sympathetic. They must be able to accept responsibility, direct or supervise others, follow orders precisely and determine when consultation is required. Nurses already have a lot of responsibility, and as health care continues to change, they're likely to get even more.

Because patients in hospitals and nursing homes require 24-hour care, nurses in these institutions may work nights, weekends and holidays. Some hospitals offer specialized work arrangements and bonus pay for nurses who are willing to work weekends.

Being an RN is hard work, but, "There's a tremendous satisfaction that comes from knowing you've helped someone," says Phil.

## How Do I Get a Job and Advance?

To get a job as a registered nurse anywhere in the United States you must graduate from a nursing program and pass a national licensing examination. There are four ways to become a registered nurse:

- You can earn an associate's degree in nursing at a two-year community college.
- You can earn a diploma through a three-year, hospital-based nursing school—although these programs are declining in number as more and more employers look for nurses with bachelor's degrees.
- You can earn a bachelor's of science in nursing at a four-year college.
- If you already have a bachelor's degree in another subject, you can earn a master's degree in nursing.

You'll combine classroom instruction with clinical, hands-on experience. You'll study anatomy, physiology, microbiology, chemistry, nutrition, psychology and other behavioral sciences, and nursing. A growing number of nursing programs include clinical experience in nursing homes, public health departments, home health agencies and clinics.

There have been several attempts to raise the educational requirements for an RN license to at least a bachelor's degree. Even without the requirement, a four-year degree is necessary for advancement to many of the better paying jobs in this field.

Nurses with experience can advance in several ways. They may move into nursing management, although many of the highest management jobs in nursing now require a master's degree. Some nurses continue their education and specialize as a nurse practitioner, a nurse midwife or a nurse anesthetist. These positions require one or two years of graduate education, leading to a certificate or a master's degree.

Some nurses move into the business side of health care. Their nursing expertise and experience on a health care team gives them the skills to manage ambulatory, acute, home health or chronic care services. Some are hired by health care corporations for jobs in planning and development, marketing and quality assurance.

## How Much Money Will I Make?

The average salary for all registered nurses is $36,200. Nurse practitioners earn significantly more ($66,800). Nurse midwives ($70,100) and nurse anesthetists ($82,000) also earn much higher salaries.

## To Learn More

For information on becoming a registered nurse, contact the American Nurses Association, 600 Maryland Ave. SW, Washington, DC 20024; (www-.ana.org); or the National League For Nursing, 61 Broadway, New York, NY 10006; (800) 669-1656 (www.-nln.org).

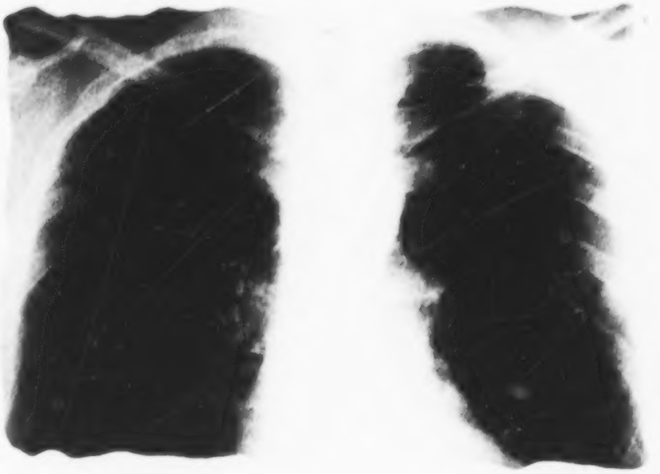
Young men who are interested in a nursing career may want to contact the American Assembly of Men in Nursing, 7794 Grow Drive, Pensacola, FL 32514; (904) 474-0144 (aamn@aol.com).

For links to many nursing organizations, visit the Nursing Center, www.nursingcenter.com/career/norg_page1.cfm.

### Did You Know?

**This is the largest health care occupation, with more than 1.9 million jobs.**

# Respiratory Therapists



**Are you precise and detail-oriented?**

**Do you like helping people?**

**Can you work as part of a team?**

## Job Outlook

A 46 percent increase, to 119,000 jobs, by 2006. The need for respiratory care professionals is expected to grow due to the large increase in the elderly population; the impact of environmental problems that already have contributed to yearly rises in the number of reported asthma cases; and technological advances in the treatment of premature babies and heart attack, cancer and accident victims

You can live without water for a few days and without food for a few weeks. But without oxygen you'll die in about nine minutes—having already suffered massive brain damage.

If you're like most people, you take breathing for granted. But if you're one of the thousands of Americans who suffer from breathing problems—patients with chronic lung conditions such as asthma, bronchitis and emphysema; heart attack or accident victims; premature infants; or those suffering from cystic fibrosis, lung cancer or AIDS—each breath is a major accomplishment.

Patients with breathing problems can be helped by respiratory therapists. These health care professionals evaluate, treat and care for patients with breathing disorders.

## What's It All About?

Respiratory therapists see many types of patients—from premature infants whose lungs are not developed to elderly people whose lungs are diseased. They use oxygen or oxygen mixtures, chest physiotherapy and aerosol medications to help patients who have stopped breathing or who cannot get enough oxygen.

Sometimes respiratory therapists must provide emergency care. A drowning victim, a person who is in shock or someone who has suffered from heart failure or stroke may have stopped breathing altogether. In these cases, respiratory therapists work quickly to start the patient breathing again. They may insert a tube into the patient's trachea (windpipe) and connect the tube to a ventilator that will force oxygen into the lungs until the patient is able to breathe again. (Some patients—for example, those with spinal cord injuries—may require use of a ventilator throughout their life.)

Sometimes patients can breathe on their own but cannot get enough oxygen to keep their body functioning. Often these are people with chronic asthma or a disease like emphysema. In these cases, a respiratory therapist might set up equipment to provide the patient with more oxygen—an oxygen tent, an oxygen mask or a special tube called a nasal cannula that is inserted into the patient's nostrils.

Respiratory therapists play an important role in treating patients with lung diseases that cause mucus to collect in the lungs, such as cystic fibrosis. They place patients in a position that will make draining the mucus easier. Then they thump and vibrate the patient's rib cage and instruct the patient to cough.

Some respiratory therapists are found in the operating room. During surgery, a patient's breathing slows down and mucus may collect in his or her lungs. A respiratory therapist may use physiotherapy to remove the mucus so the patient can start breathing safely again.

Home health care is becoming an increasingly important part of a respiratory therapist's job, as changes in the medical profession mean more people are at home for extended care. A respiratory therapist may teach the patient or family how to use a ventilator or other life-support system. He or she also may make emergency visits if equipment problems arise.

Smoking is a cause of some of the lung disorders respiratory therapists must treat. As part of their goal of improving the health of everyone's lungs, they may conduct smoking cessation programs for both hospital patients and others in the community who want to kick the tobacco habit.

## What's It Really Like?

One of the first things respiratory therapists do is test the capacity of the patient's lungs and analyze the amount of oxygen and carbon dioxide he or she is receiving. Respiratory therapists have patients breathe into an instrument that measures the volume and flow of oxygen as they breathe in and out. When they compare the patient's reading with what's normal for a person of that age, height and weight, therapists can start to diagnose the patient's problem. Here are some of the other things respiratory therapists do when they are diagnosing. They may:

- Obtain and analyze sputum (a mixture of saliva and mucus from the lungs and breathing passages). They also may take blood specimens and analyze them to determine levels of oxygen, carbon dioxide and other gases.
- Interpret the data obtained from these specimens.
- Perform stress tests and other studies of the cardiopulmonary system.
- Study disorders of people with disruptive sleep patterns.

Once the problem has been diagnosed, a medical team that includes doctors, nurses and respiratory therapists will come up with a treatment plan for the patient. The respiratory therapist is likely to be the one most directly responsible for carrying out the therapy, however. This may involve using an oxygen mask or a nasal cannula for a patient who needs more oxygen. It may involve administering an aerosol medication—usually liquid medications suspended in a gas that forms a mist that the patient inhales. (You may have friends who use a type of aerosol medication known as a nebulizer for asthma.) The following are some of the things respiratory therapists do when treating patients. They may:

- Operate and maintain various types of highly sophisticated equipment to administer oxygen or to assist with breathing.
- Use mechanical ventilation for treating patients who cannot breathe adequately on their own.
- Monitor and manage therapy that will help a patient recover lung function.
- Conduct rehabilitation activities, such as low-impact aerobic exercise classes, to help patients who suffer from chronic lung problems.
- Maintain a patient's artificial airway, one that may be in place to help the patient who can't breathe through normal means.

Most therapists—nine out of 10—work in hospitals. They generally work between 35 and 40 hours per week, but because hospitals operate around the clock some therapists work nights, weekends and holidays. Therapists spend long hours on their feet and, in an emergency, they need to work quickly and accurately under a great deal of stress. Gases used by respiratory therapists may be hazardous because they are used and stored under pressure.

## How Do I Get a Job and Advance?

You'll need either a two-year associate's degree or a four-year bachelor's degree in respiratory therapy. You'll study human anatomy and physiology, chemistry, physics, microbiology and mathematics. In 47 states, you'll need to take an examination and be licensed—either as a certified respiratory therapy technician (CRTT) or, after a minimum of two years of clinical experience, as a registered respiratory therapist (RRT). Most employers require entry-level respiratory therapists to hold CRTT certification. Supervisory positions and those in intensive care specialties usually require RRT.

While you're still in high school, take courses in health, biology, mathematics, chemistry and physics. If your school offers a health occupations program, take advantage of it. You'll need basic mathematical problem-solving skills and an understanding of chemical and physical principles—for example, you'll need to compute medication dosages and calculate gas concentrations.

Most respiratory therapists advance by moving from care of "general" patients to "critical" ones—those who have significant problems in several organ systems, including the heart and the kidneys. A respiratory therapist also may become a supervisor or a manager of a respiratory therapy department.

## How Much Money Will I Make?

The average salary for respiratory therapists is about $33,000.

## To Learn More

For additional information on a career as a respiratory therapist, as well as links to other organizations concerned with respiratory health, contact the American Association for Respiratory Care, 11030 Ables Lane, Dallas, TX 75229; (972) 243-2272 (www.aarc.org).

For a list of currently accredited programs in respiratory therapy, write to the Joint Review Committee for Respiratory Therapy Education, 1701 W. Euless Blvd., Suite 300, Euless, TX 76040.

### Did You Know?

More than 10.3 million Americans, including 3.7 million children, are afflicted with asthma. The total health care and indirect costs associated with the disease come to nearly $6 billion.

# Surgical Technologists

**Do you have the dexterity to handle delicate medical instruments?**

**Are you conscientious and orderly?**

**Are you calm in pressure-filled situations?**

*"The patient is hemorrhaging."*

*"Cauterize—now."*

*"I need suction."*

In surgery, a delay of a few seconds can be a life-and-death matter. So when a surgeon needs an instrument or piece of equipment, it must be immediately available and properly prepared for use. That's what surgical technologists do. This fast-growing occupation is ideal for someone who wants the excitement of being in an operating room but doesn't want to spend years in medical training.

## What's It All About?

Surgical technologists begin their work long before either the patient or the surgeon arrives in the operating room. They prepare the operating room, laying out surgical instruments, sterile linens and other sterile solutions.

Next, they prepare the patient. Using antiseptics (a word taken from two Greek words: "anti," or against, and "sepsis," or decay), technologists clean and disinfect the incision site. Allowing germs to infect an incision site can lead to serious complications or even death. Surgical technologists may shave the area where the incision will occur. Then they transport and position the patient on the operating table.

Using sterile cloths, called "drapes," they create a sterile area around the incision site. During the operation, nothing that has not been sterilized and disinfected will be allowed within that sterile field. It's the surgical technologist's job to keep a sharp eye out to make sure everyone in the operating room maintains proper procedures to protect the sterile field.

In that role, some surgical technologists may act as a "circulator"—responding to the needs of the team members within the sterile field. The circulator gets, opens and holds packages or other supplies the "sterile" team members may need to continue the surgery. The circulator also interviews patients before surgery, keeps a written account of the surgical procedure and answers the surgeon's questions about the patient during the operation.

During the surgery, the surgical technologist passes instruments, sponges and sutures to the surgeon. He or she may hold retractors, cut sutures and help count sponges, needles, supplies and instruments. The surgical technologist may prepare, care for and dispose of specimens taken for laboratory analysis. He or she also may help apply dressings.

Surgical technologists also may be responsible for operating certain equipment: sterilizers, lights, suction machines and other diagnostic implements. They also maintain supplies of fluid, such as plasma and blood.

## Job Outlook

This is one of the fastest-growing occupations. An employment increase of 32 percent, to 64,000 jobs, is expected by 2006. As the population ages, there will be an increasing demand for surgical technologists, since older people require more surgical procedures.

Surgical technologists don't end their work when the operation is complete. They transport the patient to the recovery room. Then they clean and restock the operating room so it's ready for the next patient and the next surgery.

## What's It Really Like?

This job combines fast-paced action with lots of precise detail work. Before the operation, surgical technologists need to be precise and exacting as they sterilize instruments and set up the operating room. In this part of the job there is no margin for error—an instrument that has not been properly sterilized can cause infection or even death.

Once the surgery begins, however, the surgical technologist's job becomes fast-paced and filled with action. Surgeons expect to have the equipment and instruments they need immediately at hand. They expect a surgical technologist to understand what instruments are going to be required without being told, and to respond quickly to anything he or she is asked.

That means surgical technologists need to have an understanding of the latest surgical techniques and procedures. They also need to have good manual dexterity, since they may need to hold an instrument in an awkward way in order to present it to the surgeon so it can be used immediately. Because operating rooms can be filled with tension, surgical technologists need to be calm and unflappable.

"People are under pressure in an OR [operating room]," says Carol, a surgical technologist. "You can't take it personally if someone speaks sharply. We all have our job to do, and if someone doesn't do their job, a patient's life could be in danger."

Of course, one of the biggest rewards of the job is knowing your efforts helped to save a patient's life. Advances in surgical techniques have made it possible to save the lives of many patients who would not have survived even a few years ago. As a surgical technologist, you'll always be on the leading edge of these life-saving advances.

Surgical technologists are on their feet for long periods of time. Although they work a 40-hour week, they may expect to be on call or work nights, weekends and holidays.

Most surgical technologists work in hospitals, and that is expected to continue in the future. Other areas of employment growth will include offices and clinics of physicians, and, especially, walk-in surgical centers. A few technologists, known as "private scrubs," are hired directly by a surgeon to be part of a team doing special, delicate surgery such as liver or heart transplants.

## How Do I Get a Job and Advance?

Many community and junior colleges, vocational schools, universities, hospitals and the military offer formal training programs. Lasting between nine and 24 months, these programs combine classroom education with supervised clinical experience.

You'll study anatomy, physiology, microbiology, pharmacology, professional ethics and medical terminology. You'll also learn about the care and safety of patients during surgery, aseptic techniques and surgical procedures. You'll get practice sterilizing instruments, learn how to prevent and control infection and be introduced to the safe handling of special drugs, solutions, supplies and equipment.

While in high school, take as many science- and health occupations-related courses as you can.

While certification is not required, more and more employers expect it for new hires. Surgical technologists who have graduated from an accredited program and passed a national examination may use the designation certified surgical technologist, or CST.

With additional training, some surgical technologists advance to becoming first assistants, who help surgeons with sponging, suturing, cauterizing bleeders, and closing and treating wounds. Other surgical technologists manage central supply departments in hospitals, or take jobs with insurance companies, sterile supply services and operating equipment companies.

## How Much Money Will I Make?

The average salary for surgical technologists is about $25,000. The starting salary is about $20,900, while experienced technologists can expect to earn about $28,000 a year.

## To Learn More

For more information on a career as a surgical technologist and for a list of accredited programs, contact the Association of Surgical Technologists, 7108-C S. Alton Way, Englewood, CO 80112 (www.ast.org). For information on how you can become certified as a surgical technologist, contact the Liaison Council on Certification for the Surgical Technologist, 7790 E. Arapahoe Road, Suite 240, Englewood, CO 80112.

### Did You Know?

**Sir Joseph** Lister was the **first to** use the practices of **antiseptic** surgery that are **still followed** in operating **rooms** today. Before the **medical** profession adopted his ideas in the late 1880s, even the most minor operation was likely to be followed by infection, and death occurred in 50 percent of all surgical cases.

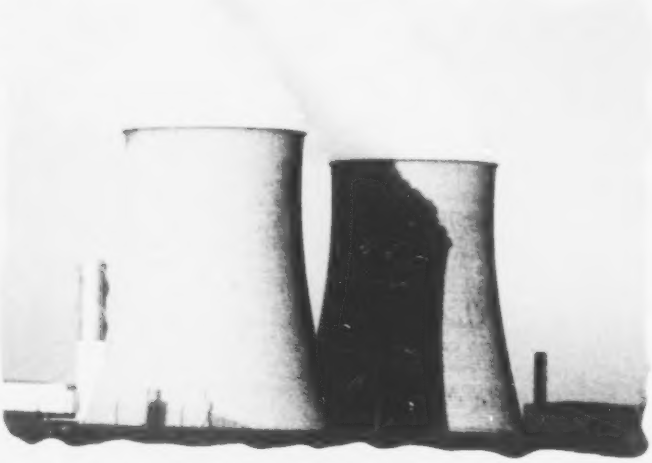
# Manufacturing and Production

# Electric Power Generating Plant Operators and Power Distributors and Dispatchers

**Are you careful and precise?**

**Do you react quickly but calmly in an emergency?**

**Do you have strong math and science skills?**



You flip a switch and the light comes on. You press a button and your microwave heats up a snack. You click your remote control and the TV shows you what's happening halfway around the world.

None of these appliances would work without power plants and a huge network of electric lines and generating equipment. And these wouldn't function without plant operators and power distributors and dispatchers.

## What's It All About?

*Power plant operators* control the machinery that generates electricity. *Power distributors and dispatchers* control the flow of electricity from the power plant over a network of transmission lines to substations, and then to homes, factories, schools, offices and retail establishments.

There are two types of power plants—fossil fuel and nuclear. Most of the electricity in the United States—about 70 percent—comes from plants that burn coal, oil or natural gas. These are called "fossil fuels" because they developed from the remains of prehistoric plants and animals. In fossil fuel electric plants, fuel is burned in huge combustion chambers to produce heat, which converts water to steam in a huge boiler. The steam drives a steam turbine, which turns the rotor of a generator that produces the electricity.

The plant operators in fossil fuel plants are responsible for making sure all these large machines stay in good working condition. They monitor the boilers, turbines and generators. They distribute power demands among the various generators in the power plant. If power requirements change, they start or stop generators or disconnect them from power circuits.

In newer plants, the operators work in a central control room. In an older facility, the controls for the equipment are located throughout the power plant, and operators spend their time working in the plant, manually operating valves, switches and gauges.

Nuclear power plants operate differently. Like fossil fuel plants, they use steam to drive huge turbines and generators. But instead of using coal or oil, these plants feature nuclear reactors powered by uranium. In the reactor, the uranium fissions—its nuclei split in two. As the nucleus splits, it releases energy. The fission of one pound of uranium releases as much energy as burning 1,140 tons of coal.

Operators of nuclear power plants must be licensed by the Nuclear Regulatory Commission (NRC). They operate the equipment that affects the power of the reactor. Typically, the control room of a nuclear power plant contains hundreds of electronic devices that help operators monitor everything from the amount of energy being generated

## Job Outlook

A 4.3 percent increase, to [illegible] jobs, by 2006.

to the plant's safety systems.

Once the electricity is generated, it travels from power plants along overhead wires called transmission lines. Controlling that process is the job of power distributors and dispatchers.

As the electricity travels through transmission lines, the lines resist the current flow, which causes the current to lose energy. Power plants limit that energy loss by transmitting energy at very high voltages. While some industrial plants can use electricity at a high voltage, most homes, schools, factories and offices cannot. So the electric voltage must be decreased before it is sent to most electricity users.

Power distributors and dispatchers—also called load dispatchers or systems operators—operate current converters, voltage transformers and circuit breakers. They send high-voltage current to some industrial plants and to substations near the area where the power will be used. Those substations have transformers that reduce the voltage and then send it through distribution lines to homes, factories, schools, retail establishments and offices.

Dispatchers use a pilot board, which is a map of the transmission grid system. It shows them the status of transmission circuits and connections with substations and industrial plants. In an emergency, such as the failure of a transformer or transmission line, dispatchers route current around the affected area. Dispatchers also anticipate power needs. If they foresee a need for more power—for example, if the temperature is expected to drop suddenly—they call the control room operators so they can produce the energy required. Electricity cannot be stored, so if there is a greater demand for electricity than the power plant can generate, the dispatchers may have to reduce the voltage in order to prevent a blackout.

Today, most transmission networks are connected. Through these "power pools," an electric company that needs power may receive it from another electric company miles away. Computers help control the supply and flow of electricity through these power pools.

## What's It Really Like?

This work isn't physically strenuous, but you do need to pay constant attention. In most cases, the work involves sitting or standing at the control station. Operators, dispatchers and distributors need to keep a close watch on power demands and on the equipment that generates the power. If there's a malfunction, thousands of homes and offices could lose their electricity.

Because people need power around the clock, operators, distributors and dispatchers are usually assigned to work one of three daily eight-hour shifts. These assignments are changed regularly so no one is permanently stuck on the least desirable shifts. But the constant change in work times can be stressful and fatiguing.

Safety is important for workers at all power plants, but it is critical for those who operate nuclear power plants. Nuclear power plant operators are subject to random drug and alcohol tests, as are all workers at most nuclear power plants.

## How Do I Get a Job and Advance?

For an entry-level job in a power plant you need at least a high school diploma. You need strong computer skills, and you should take as many math and science courses in high school as possible.

Usually people are hired as a helper or a laborer and then may be assigned to train for other positions. Trainees go through both on-the-job training and classroom instruction before becoming a fully qualified control room operator or power distributor. That's a process that usually takes several years.

In a nuclear power plant, trainees should have a strong background in math and science. Experience at other power plants or with Navy nuclear propulsion plants is helpful. It takes extensive education—a combination of classroom instruction and on-the-job and simulator training—and experience to pass the NRC's exams for licensed reactor operator and senior reactor operator. These tests include both a written exam and a practical plant operation exam. Once they are licensed, reactor operators need to pass an annual practical exam and must take a written examination every two years.

Nuclear power plant operators must update their skills regularly. Usually this occurs on simulators that recreate situations operators might expect to encounter on the job.

## How Much Money Will I Make?

Earnings in this field vary widely but are generally quite high. In fossil fuel power plants, operators earn an average of about $43,600 a year. Operators in nuclear power plants earn about $52,000 per year. For power distributers and dispatchers, the figure is about $50,000.

## To Learn More

For general information about power plant and nuclear reactor operators and power distributors and dispatchers, contact the International Brotherhood of Electrical Workers, 1125 15th St. NW, Washington, DC 20005 (www.ibew.org). For a copy of "Careers in Electric Power," send $5 to Edison Electric Institute, P.O. Box 2800, Kearneysville, WV 25430. For general information about electric power, visit the organization's Web site (www.eei.org).

### Did You Know?

Thomas Edison not only invented the light bulb, he also created the first power company to get electricity to the people who would buy his light bulbs. On Sept. 4, 1882, Edison's Pearl Street Station began operating in New York City. It provided service to 85 customers and their 400 lamps.

# Engineering Technicians in Manufacturing

**Are you interested in machinery design and application?**

**Do you have a methodical approach to problem solving?**

**Can you work as part of a team?**

The company had a problem. It was having trouble finding workers to do the repetitive (and relatively low-paying) work on the production line. It was willing to hire people with mental and physical disabilities, but that would involve making changes in the way the line was set up.

A team that included both engineers and engineering technicians studied the problem carefully. They analyzed the work that needed to be done and figured out the best way to accomplish each task. The result? The company found the workers it needed and people with disabilities had a chance to earn a salary.

If you are interested in solving problems like these, but you don't want to get a four-year engineering degree, you might consider a career as an engineering technician. In the manufacturing field, engineering technicians may find the results of their work in a factory, a space vehicle or a hospital operating room where critical lifesaving equipment stands ready to assist the surgical team during high-risk operations.

## What's It All About?

Manufacturing engineers are responsible for devising and maintaining efficient and reliable manufacturing systems to produce products.

Manufacturing engineering technicians work with them, using the principles and theories of science, engineering and mathematics to solve technical problems in research and development, manufacturing, inspection and maintenance. Their work is more limited, and generally more practically oriented, than the work of scientists or engineers.

For example, a team that included both engineers and engineering technicians might develop alternatives for making a part or device, considering both the costs of the manufacturing procedures and the inventory control that would be required for each alternative. They also might be asked to develop a step-by-step automated manufacturing method for making a product.

Engineering technicians involved with manufacturing may prepare specifications for materials, devise and run tests to ensure product quality or study ways to improve manufacturing efficiency. They also may supervise production workers to make sure they follow prescribed procedures.

Most engineering technicians specialize in a particular area, and they learn many of the same skills and work in the same disciplines as engineers. The following are some of the job titles available for engineering technicians within the manufacturing field:

*Chemical engineering technicians* usually work in industries that produce pharmaceuticals, chemicals or petroleum products. They work in laboratories as

## Job Outlook

**A 10 percent** increase, to [illegible] **jobs, by** 2006.

well as processing plants. They help develop new products and processes, test processing equipment and instrumentation, monitor quality and operate chemical manufacturing facilities.

*Industrial engineering technicians* study the efficient use of personnel, materials and machines in factories, stores, repair shops and offices. They prepare layouts of machinery and equipment, plan the flow of work, make statistical studies and analyze production costs.

*Mechanical engineering technicians* carry out less complex technical-support functions in mechanical engineering research, design, construction, operations and maintenance. They may develop drawings in the design process of new machinery or equipment, often using computer-aided design (CAD). They may assemble and install mechanical equipment, parts, machine tools and controls and help construct, maintain and repair engineering machinery. They also may perform workshop and field tests using standard instruments and methods, and assist in developing quality control tests for products and parts. Some may even design precision equipment, machine tools and production machinery.

Mechanical engineering technicians can specialize as boiler-testing technicians, hydraulic control technicians, mechanical detail drafters, mechanical engineering drafters, pipe-testing technicians or tool design detail drafters.

## What's It Really Like?

Most engineering technicians involved with manufacturing work regular hours. They may work in an office, technical laboratory or workshop, or do on-site work.

Usually technicians are part of a team. They need good communication skills and the ability to work well with others.

The rewards of the job come from solving complicated problems. Technicians may be exposed to hazards from equipment or toxic materials.

## How Do I Get a Job and Advance?

It is still possible to get some engineering technician jobs without formal training. But employers prefer people with at least a two-year degree in engineering technology. You can take these courses at technical institutes, junior and community colleges, public and private vocational-technical schools, and through some technical training programs in the armed forces. If you've taken college-level courses in engineering, science or mathematics, you may qualify for some positions, although you'll probably still need additional specialized training and experience.

The armed forces offer training in some of the technical aspects of this job. The skills acquired in military programs are often narrowly focused, however, and don't always transfer to civilian industry, which requires broader training. You may need additional training after your military service.

Look carefully at any school before you choose to enroll. Many schools say they offer engineering technician training programs, but the quality of these programs varies considerably. You can feel confident if the program has been accredited by the Accreditation Board for Engineering and Technology (ABET).

Another word of caution: Some community colleges offer a two-year pre-engineering program. While those programs often do a good job of preparing students to enroll in a four-year college engineering program, they may not be the best preparation for a job as an engineering technician. The courses that do the best job of preparing students for jobs as engineering technicians are those that stress hands-on applications rather than engineering theory. On the other hand, some of the courses required for a certificate as an engineering technician would not count toward a four-year engineering degree. So you don't waste your time or money, it's helpful to have a clear idea about your ultimate career goal—whether it's to be an engineer or an engineering technician—before you enroll.

If you want to be a mechanical engineering technician, you need additional courses in fluid mechanics, thermodynamics and mechanical design. You'll also need college-level algebra and trigonometry as well as several basic science courses. Courses in CAD are valuable as well.

Once hired, you'll probably start by handling routine duties under the close supervision of an experienced technologist or an engineer. As you gain experience, you'll be given more responsibility and more challenging assignments.

## How Much Money Will I Make?

Starting salaries for engineering technicians begin at about $20,000. People in the most senior-level positions can earn about $55,000.

## To Learn More

Information on engineering technology programs that have been accredited by the ABET is available from the organization at 111 Market Place, Suite 1050, Baltimore, MD 21202 (www.abet.ba.md.us).

### Did You Know?

Engineering technicians increasingly work with robotics. For example, they might be asked to work on a team that is automating the production of vaccines or antibiotics with robots and remote-control devices in a germ-free environment.

# Machinists and Tool Programmers

**Do you have good vision and excellent hand-eye coordination?**

**Do you have an eye for detail?**

**Do you have a love of quality and precision?**

From Robert Fulton's steamboat to Henry Ford's assembly line to the modern aircraft industry, many of the advances that have made our lives easier would have been impossible without the help of skilled machinists. Automobiles, radios, refrigerators, airplanes and television sets all include parts made by machine tools. Books, furniture and textiles are among the products made by machines manufactured with machine tools. In fact, it's hard to think of a complicated construction, engineering or manufacturing project that has not required the skill of machinists to bring it to completion.

That's what machinists love about their job. Every day, they get the satisfaction of creating something from nothing.

## What's It All About?

Machinists and tool programmers are among the most highly skilled industrial workers. They use machine tools such as lathes, drill presses and milling machines to produce precision metal parts. Although they may produce large quantities of one part, machinists more often produce small batches or one-of-a-kind items. They combine their knowledge of the working property of metals with their skill in operating machine tools to make machined products that meet precise specifications.

Before they machine a part, *machinists* carefully plan and prepare the operation. They review blueprints or written specifications for the job. Next, they calculate where to cut or bore into the workpiece, how fast to feed the metal into the machine and how much metal to remove. They select the tools and materials they'll need for the job, plan the sequence of cutting and finishing operations and mark the metal stock to show where cuts should be made.

Then they perform the actual machining operations. Machinists position the metal stock on tools such as lathes, drill presses or milling machines. They set the controls and make the cuts. During this process, they constantly monitor the feed and speed of the machine. They also make sure the workpiece is being properly lubricated and cooled, since the machining of metal products generates a lot of heat.

Some machinists, often called production machinists, may produce large quantities of one part. Generally, these are parts that require complex operations and great precision. More routine metalworking is usually assigned to machine operators. Other machinists do maintenance work, repairing or making new parts for existing machinery.

The entire toolmaking and machining industry is increasingly relying on machinery that contains computer controllers to tell the machine what to do and when to do it. These computer numerically controlled (CNC) machines

## Job Outlook

More than 350,000 jobs through 2006. Job increases are anticipated in both aircraft and automobile manufacturing.

are part of the transformation of manufacturing from a low-tech process that involved lots of people operating a few pieces of machinery to a computer-controlled process that uses a few highly skilled workers to operate a number of high-tech machines.

For a CNC machine, the controller "reads" a program—a coded list of the steps necessary to perform a specific machining job—and runs the machine tool's mechanisms through the steps. CNC machines make it possible for machinists to be more productive and to produce parts with a level of precision that was not possible before. Some specifications call for shaping a piece of metal to within one-one-thousandth-of-an-inch accuracy. Furthermore, these computer-controlled machines can repeat that precision performance over and over again.

Of course, that's only possible if the programs that control the machines are of high quality. Developing those programs is the responsibility of *tool programmers*. They start their work in much the same way that machinists do—by analyzing blueprints and specifications, computing the size and position of the cuts the machine must make, selecting appropriate tools and calculating machine speed and feed rates. Then they write a program in the language of the machine's controller.

Today, many CNC machines have become more user-friendly, and so it is not uncommon for skilled machinists to write programs. These technological advances are increasing the need for tool programmers to be multifaceted and have good machining skills.

## What's It Really Like?

Most machinists work in specialty shops that take specific orders for needed parts and equipment. These shops usually employ between four and 15 machinists. Other machinists work for large concerns that use metal in their final products, such as heating-vent manufacturers or automobile factories.

Working with metals can be dangerous, so machinists need to pay close attention to their work. They wear safety glasses to shield themselves against bits of flying metal and earplugs to protect their ears from machinery noise. They must carefully decontaminate themselves after working with hazardous coolants and lubricants, some of which can be quite toxic.

Machinists report that their biggest concern on the job is the threat of injury. But because most take such careful precautions, the average injury rate in this profession is only slightly higher than the national average.

Most machinists work a 40-hour week. Evening and weekend shifts are becoming more common, since employers want to maximize the investment they have made in expensive machinery. Overtime work is sometimes necessary.

## How Do I Get a Job and Advance?

A high school education is the minimum requirement for an entry-level job in the field. To advance, most students will need an associate's degree in machine technology.

Employers especially look for applicants who have taken courses in mathematics and machine technology. Because of the increased use of computer-controlled machine tools, a knowledge of computers and electronics is also valuable. Blueprint-reading skills are desirable as well.

Real-world experience is helpful, too. Some people learn this trade through apprenticeship programs sponsored by trade unions or groups of employers. Apprenticeship programs may take more than four years to complete. They generally combine shop work with at least 600 hours of classroom instruction. In more than 8,000 hours of shop work, apprentices learn filing, hand-tapping and dowel fitting, as well as how to operate various machine tools. Classroom instruction includes math, physics, blueprint reading, mechanical drawing and shop practices. It also includes training in the operation and programming of CNC equipment.

Most individuals who choose a career as a machinist remain machinists, since there are very few jobs that offer this combination of precise detail work and variety. Machinists may advance by becoming department managers or team leaders. A few start their own companies, although the large startup costs make this difficult.

## How Much Money Will I Make?

The average salary for machinists is about $28,600. But with experience, machinists can expect to earn salaries in the $40,000 to $60,000 range.

## To Learn More

For information about a career as a machinist or a tool programmer, contact the National Tooling and Machining Association, 9300 Livingston Road, Fort Washington, MD 20744; (301) 248-6200 (www.ntma.org).

For general information, contact the Precision Machined Products Association, 6700 W. Snowville Road, Brecksville, OH 44141; (440) 526-0300 (www.pmpa.org).

### Did You Know?

**The** space shuttle is made **of tens of** thousands of **individually** formed pieces **of metal.** The forward fuse**lage structure** alone con**sists of** 2,024 aluminum-**alloy** panels, frames and **bulkheads.**

# Printing Press Operators

**Do you like to fix mechanical things?**

**Do you have good manual dexterity?**

**Do you have the ability to visualize how printed materials will look when colors are combined?**

You've undoubtedly heard the words "Stop the presses!" shouted by frantic editors in dozens of movies and television programs. But did you ever stop to think about who actually does stop—and start—the presses that bring the newspaper that lands on your doorstep each morning, the magazine you pick up in the supermarket, and this book you're reading right now?

They're printing press operators. And, despite technological innovations, these skilled craftspeople still have an important role to play in our information economy.

## What's It All About?

Printing press operators prepare, operate and maintain the printing presses in a pressroom. They're the people who actually put ink on paper.

They prepare the presses for printing by installing and adjusting printing plates, adjusting pressure, inking the presses, loading paper and adjusting the press to the paper size. They ensure that paper and ink meet specifications—a customer who wants a specific shade of blue will not be happy if the printed item is not that precise color. She may insist that the job be reprinted, causing lost time and money.

Press operators adjust the flow of ink to the inking rollers. They then feed paper through the press cylinders and adjust feed and tension controls. Once the presses are running, press operators keep an eye on the machines to make sure things are operating smoothly. They keep the paper feeders well stocked. They make small adjusfments to correct uneven ink distribution or other printing problems. If the paper tears or jams, they quickly correct the problem to minimize downtime.

It's a job that involves a lot of mechanical know-how. Printing press operators need to know the mechanical workings of the machines they use since they are often called on to make small adjustments to ensure a high-quality finished product. They also are the people responsible for keeping the expensive printing machinery up and running, and for making quick corrections to avoid expensive losses of paper and ink.

"Technology innovations have had a dramatic impact on this industry," says Edward, a printer and a union official. Increasingly, computer technology is becoming an integral part of the job of a printing press operator. Most printing plants have, or soon will have, printing presses that use computers and other sophisticated technology to control press operations. This will make it possible to set up jobs in less time. With this equipment, press operators also can keep track of the job by looking at a control panel that allows them to make electronic adjustments to the printing press.

## Job Outlook

A 2.5 percent increase, to 250,000 jobs, by 2006.

## What's It Really Like?

What you do as a printing press operator depends directly on the type of press you operate. Most printing presses still use offset lithography, which transfers an inked impression from a rubber-covered cylinder to paper or other material to be printed.

There are two types of printing that are expected to be used increasingly in the future. Gravure printing involves applying ink to a metal plate that has had an impression etched onto it. The metal plate is then pressed to paper. Flexography is a type of printing that involves a flexible rubber printing plate with a raised image area. The ink is applied to the raised area, and the plate is then pressed to paper.

In some printing shops, you'll work on a relatively small press, which may print only one or two colors at a time and is operated by one person. In newspaper or magazine press rooms, you're likely to work on a "web press"—a huge printing press that prints paper on both sides, trims, assembles, folds pages and counts the finished sections as they come off the press. This press gets its name because it uses a huge roll, or "web," of paper up to 50 inches wide. Web presses require several press operators and press assistants.

Printing press operators must be mechanically inclined so they can make adjustments and repairs quickly. They also need the ability to visualize what print materials will look like when colors are combined so they can work on color presses. They need basic math skills so they can calculate the amount of ink and paper needed to do a job.

While the end result—a sharp, clean-looking newspaper, magazine or book—can be very satisfying, this job also can be quite demanding. You'll be on your feet most of the day, working under pressure to meet deadlines. Pressrooms are noisy, and you may need to wear ear protectors. There are fewer accidents with today's computer-controlled presses, but it's still important to heed to safety procedures at all times.

You should expect to work some overtime. Many press operators—especially those working for newspapers—work night or overnight shifts.

There are printing and publishing jobs in virtually every state and city—the industry is one of the most geographically dispersed in the United States. But jobs are concentrated in large printing centers: New York, Los Angeles, Chicago, Philadelphia, Dallas and Washington, D.C.

Although technology has reduced the need for press operators on existing publications, an economy that is increasingly based on information is driving up demand. As American publications expand into foreign markets, jobs in this market will increase. The rise in the school-age population also leads to greater demand for textbooks and other printed materials. And changes in advertising—as marketers increasingly used personalized direct mail to target specific customers—will lead to more jobs as well.

## How Do I Get a Job and Advance?

Most people still learn the trade on the job, although formal apprenticeship and training programs are becoming increasingly important as computer technology takes over the business. If you learn on the job, you'll start by working as an assistant or a helper to an experienced operator. You'll load, unload and clean the presses. In time, you'll move up to operating a small, one-color press. Eventually you'll advance to multicolor presses.

If you enroll in an apprenticeship program you'll spend four years in a combination of classroom and on-the-job instruction. There also are programs in printing equipment operation offered by vocational schools and community colleges. Some of these programs take two years, but most are about a year long.

As technology continues to bring changes to this industry, training will not stop when you get a job. You should expect to be retrained several times during your career.

In high school, you need to get a good foundation in math. Because of the technological changes in the printing industry, courses in chemistry, electronics and physics also are helpful.

Advancement in both pay and responsibility usually involves taking a job on a more-complex printing press. For example, a one-color, sheet-fed press operator may become a four-color, sheet-fed press operator. Others may advance to pressroom supervisor or even take responsibility for the work of the entire press crew.

## How Much Money Will I Make?

The average salary is about $25,100. The top 10 percent in this field in salary earn about $44,000 a year.

## To Learn More

For information on careers and training in printing and the graphic arts, contact the Printing Industries of America, 100 Daingerfield Road, Alexandria, VA 22314; (703) 519-8100 (www.printing.-org).

For an information package about careers in the graphic arts industry, including being a printing press operator, contact the National Scholarship Trust Fund, 200 Deer Run Road, Sewickley, PA 15143; (412) 741-6860 (nstf@gatt.lm.com).

For general information about press operators, contact the Graphic Communications International Union, 1900 L St. NW, Washington, DC 20036; (202) 882-3000.

### Did You Know?

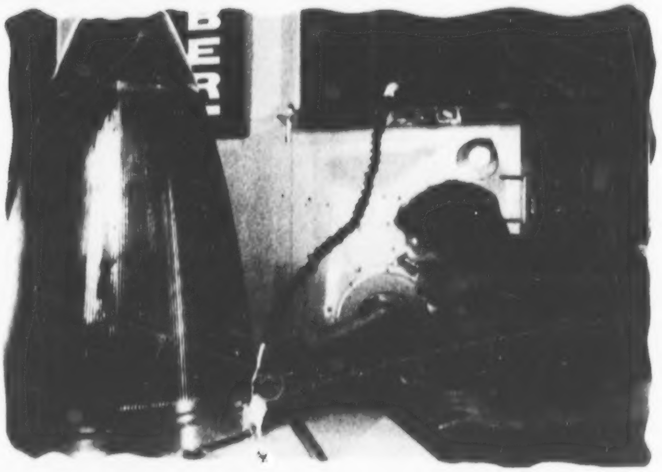
Benjamin Franklin was a printer. He started as an apprentice at the age of 12.

# Tool and Die Makers

**Are you patient and precise?**

**Do you enjoy working independently?**

**Can you spend long periods of time at a task that requires intense concentration?**



If someone says the word "tool," what do you think of? A wrench? A hammer? Actually, a tool is anything that is used as a means of production. Special tools—such as dies and molds—are custom designed and used to manufacture specific products to desired levels of uniformity, accuracy, interchangeability and quality.

Tool and die makers produce the tools, dies and special guiding and holding devices that allow machines to manufacture many of the products we use every day—from clothing to computers, automobiles to aircraft, faucets to furniture. In fact, nearly every manufacturer will do business at one time or another with the companies that employ tool and die makers.

## What's It All About?

Tool and die makers are among the most highly skilled production workers in the economy. *Toolmakers* craft precision tools that are then used to cut, shape and form metal and other materials. They also produce jigs and fixtures (devices that hold metal while it is bored, stamped or drilled) and gauges or other measuring devices.

*Diemakers* construct the metal forms—or dies—that are used to shape metal in stamping and forging. They also make the metal molds for diecasting and for molding plastics, ceramics and composite metals. In addition to creating new tools and dies, they also may repair worn or damaged tools, dies, gauges, jigs and fixtures.

Because they have such a wide range of responsibilities, tool and die makers usually need to have a much broader knowledge of machining operations, mathematics and blueprint reading than do most other machining workers. They use a full range of machine tools and related equipment, ranging from small automatic lathes for miniature parts to enormous boring mills. They need an understanding of the machining properties—such as hardness and heat tolerance—of a wide variety of common metals and alloys.

The job typically follows this pattern: First, the tool or die makers consult blueprints or instructions. Next, they map out the sequence of operations needed to manufacture the particular tool or die. Then they measure and mark the pieces of metal they will cut to form parts of the final product. Next, they go to work—cutting, boring or drilling the part. They continuously check the accuracy of their work to ensure that the final part will meet specifications. Finally, they assemble the parts and perform finishing operations, including filing, grinding and smoothing surfaces.

Modern technology is changing the way tool and die makers do their jobs. The industry is probably the most tech-

## Job Outlook

The number of jobs in the field is expected to drop slightly to 150,000 by 2006, but that doesn't mean work will be harder to come by. In fact, just the opposite is true. Many veteran craftspeople are nearing retirement, and there are few qualified candidates in the pipeline to fill the vacancies.

nologically advanced of all small manufacturing activities. There is widespread use of computer numerically controlled (CNC) machines and computer-aided design and manufacturing (CAD/CAM) techniques. These techniques save time and increase worker productivity.

Even with the technology, tool and die makers themselves still play a vital role. It takes knowledgeable workers to select the proper techniques and arrange the processes in the best order.

## What's It Really Like?

Due to the nature of the work, tool and die making requires a clean, well-lighted, controlled enviroment. Tool and die production areas are usually quieter than one might expect because few machines are in use at any one time.

Safety is important. While the machinery used by tool and die makers does have guards and shields for safety, it's still important to pay close attention to safety regulations. Typically, tool and die makers wear safety glasses to shield them from bits of flying metal, earplugs to protect their hearing, and gloves and masks to reduce their exposure to hazardous lubricants and cleaners.

If you become a tool or die maker, you'll need a combination of stamina and patience. Stamina because you're likely to be on your feet for most of the day. Patience because you need to make sure your work meets the exacting specifications required.

For the most part companies that employ tool and die makers are small, usually with 25 to 30 employees. These traditionally were 9-to-5 jobs, with some overtime required. But as the cost of new machinery and technology has gone up, many employers have added a second shift. Overtime and weekend work are expected during peak periods.

## How Do I Get a Job and Advance?

It takes four to five years of education and training to learn this trade. You'll start with a formal apprenticeship that combines classroom instruction and job experience, or enroll in a program at a community college or technical school, or receive informal on-the-job training. "I definitely recommend starting with a formal apprenticeship or training program," says Frank, who learned his skills on the job. "You'll be able to advance much more quickly."

You'll learn how to operate milling machines, lathes, grinders and other machine tools; how to use hand tools to fit and assemble tools, gauges and other mechanical and metal-forming equipment; and how to perform such metalworking processes as heat treating and plating. Your classroom training will include mathematics, mechanical drawing, tool designing, tool programming and blueprint reading. It's increasingly important to understand CAD/CAM manufacturing and CNC machine tools.

It's still possible to enter the field by becoming a machine operator and learning skills on the job, gradually taking on more difficult assignments. But you'll probably need to take some courses to improve your skills if you want to qualify for the best jobs.

There are many avenues for advancement. You can become a supervisor or manager in your company, a tool designer or programmer, move into industrial or manufacturing engineering or even open your own business.

## How Much Money Will I Make?

Most tool and die makers earn between $31,200 and $46,800. Entry-level toolmakers average about $27,000 a year during their training program. With overtime, the top 10 percent in salary earn more than $60,000.

## To Learn More

For general information about tool and die makers or training programs, contact the National Tooling and Machining Association, 9300 Livingston Road, Fort Washington, MD 20744; (301) 248-6200 (www.ntma.-org).

Or, contact the Association for Manufacturing Technology, 7901 Westpark Drive, McLean, VA 22102; (703) 893-2900 (www.mfgtech.org).

### Did You Know?

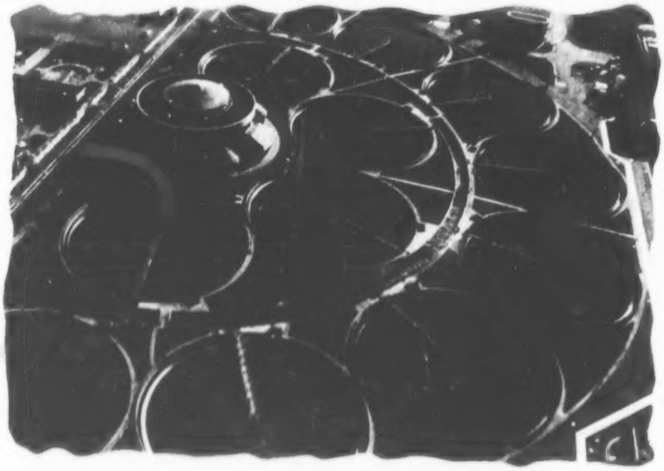
**A tool** and die maker's **work** must be accurate to **within** one *ten-thousandth* of an inch.

# Water and Wastewater Treatment Plant Operators

**Do you have mechanical ability?**

**Do you want a job that benefits the public?**

**Can you stay calm and level-headed in an emergency?**



Nearly 97 percent of the world's water is salty or otherwise undrinkable. Another 2 percent is locked in ice caps and glaciers. That leaves just 1 percent that's available for all of humanity's agricultural, residential, manufacturing, community and personal needs.

But how does that water get to the people who need it? Who's responsible for purifying it to make sure it's safe for people to drink? And who sees to it that wastewater is treated before it goes back into the water supply? Those things are all the responsibility of water and wastewater treatment plant operators.

As water pollution and health concerns increase, this is one job that's increasingly important to everyone's quality of life.

## What's It All About?

The average total home water use for each person in the United States is about 50 gallons a day. Getting that water from the wells, rivers and streams where it is collected to taps in homes and businesses, or fields where it will be used to irrigate crops, is a complicated job.

It's made more complicated by the fact that water is part of a deeply interconnected system. What we pour onto the ground and spew into the sky ends up in our water.

Water and wastewater treatment plant operators protect the water supply. Water treatment plant operators help make water safe to drink. Wastewater treatment plant operators remove harmful pollutants from domestic and industrial wastewater so it is safe to return to the environment.

Before water is distributed to customers, and again before it is returned to the water supply, it is treated and purified. Operators in both water and wastewater treatment plants control the processes and equipment that remove human and animal waste and other solid materials, chemical compounds and microorganisms from the water. They control pumps, valves and other processing equipment that move water or wastewater through a series of treatment processes. They also safely dispose of the waste materials that have been removed from the water.

Operators spend much of their time checking meters and gauges. They need to make sure the plant's equipment and processes are all working properly. They operate chemical-feeding devices, take samples of the water or wastewater, perform chemical and biological laboratory analysis, and test and adjust the amounts of chemicals such as chlorine in the water. If a valve or a gauge isn't working, they are responsible for repairing it.

Water and wastewater treatment plant operators increasingly depend on computers to help them monitor equipment,

## Job Outlook

A 23 percent increase, to 121,000 jobs, by 2006. The number of applicants in this field is normally low, so qualified job applicants should have no trouble finding a job. It's a career that offers excellent job security, since water and wastewater treatment services are both essential and required by law.

store sampling results, make process control decisions, schedule and record maintenance activities and produce reports. When a problem occurs, computers can sometimes determine the cause and suggest the best way to solve it.

## What's It Really Like?

What you'll do depends on the type and size of plant where you work. In some small treatment plants, you might be responsible for controlling all the machinery, performing tests, keeping records, handling complaints and doing repairs and maintenance. In a large plant, you might have more highly specialized duties and monitor only one process. In that case, you might work with chemists, engineers, laboratory technicians, mechanics, helpers, supervisors and a plant superintendent.

Wherever you work, though, you'll need to stay current on federal water pollution standards. For example, the 1996 Safe Water Act Amendments included new standards requiring water plants to monitor cryptosporidium and giardia—two biological organisms that have caused health problems. It's likely that future laws will impose even more stringent requirements on water and wastewater treatment plants. Safety consciousness in this job is an absolute must—the health of thousands of people depends on the job you do.

Whether you work at a water treatment plant or a wastewater treatment facility, you should expect to spend some of your day outdoors. You'll constantly need to read and interpret information from meters and gauges located throughout the plant. That may mean you'll need to stoop, reach or climb.

You'll also have to deal with machine noises and some unpleasant odors, though chemicals minimize many of the latter.

Sometimes the job can be dangerous. There may be a chlorine gas leak. A heavy rainstorm may cause large amounts of wastewater to flow into sewers, exceeding the plant's treatment capacity. In these cases, you'll need to work quickly and stay level headed.

People need water 24 hours a day, so you should expect to work shifts, and some weekends and holidays. Most water and wastewater treatment plant operators work for local governments, but there are a growing number of jobs with private water supply and sanitary services companies, many of which are contracted to provide services to local governments.

"Computers and technology are taking the place of some of the jobs at my plant," says Frank, a plant operator. "But they're also opening up other jobs at the high-tech end. The key to success, I think, is being multi-skilled. You have to be a good problem solver, so having some knowledge of welding, plumbing, pipefitting or mechanics is helpful." In fact, most of the plant operators where Frank works started in other careers.

## How Do I Get a Job and Advance?

You need basic mechanical ability to be a success in this job. "It's helpful to have a background in general industrial mechanics and heavy machinery," Frank says.

You also need to know basic math, since you'll apply data to formulas for treatment requirements and flow and concentration levels. Because you'll probably be using computers in your work, a high school diploma is usually required. Most employers prefer hiring people who have taken high school courses in chemistry, biology and mathematics. Trainees usually start by learning their skills on the job under the guidance of an experienced operator.

You can earn an associate degree in water or wastewater technology, or take a one-year certificate program. This advanced training will increase your career possibilities, and you may find that your employer will pay some or all of the cost of this training.

You also can take courses offered by state drinking water and water pollution control agencies. These courses cover the principles of treatment and process control, laboratory procedures, maintenance, management skills, collection systems, safety, chlorination, sedimentation, biological treatment, sludge treatment and disposal and flow measurements. You may take related college courses in science or engineering—quite possibly with your employer picking up part of the tuition.

Advancement requires responsibility for more-complex treatment processes. Some operators become plant supervisors or superintendents. Others advance by moving to a larger facility. With each promotion, you'll need a greater knowledge of federal, state and local regulations. And if you want to be the superintendent of a large plant, you'll probably need an engineering degree.

In 49 states, operators must pass an examination that certifies their ability to oversee wastewater plant operations. Typically, there are different levels of certification depending on your experience and training.

## How Much Money Will I Make?

The average salary for water and wastewater treatment plant operators is $28,600, but the top 10 percent in salary earn about [illegible]2,000 and some operators earn more than $50,000. Salary depends on the size and location of the plant, the complexity of the operator's job and the operator's level of certification.

## To Learn More

For general information on water and a career as a water treatment plant operator, contact the American Water Works Association, 6666 W. Quincy Ave., Denver, CO 80235; (303) 794-7711 (www.awwa.org). This site has links to local water treatment authorities in many states. Or, contact the Water Environment Federation, 601 Wythe St., Alexandria, VA 22314; (703) 684-2400.

### Did You Know?

**There is the same amount of water on earth today as there was when the planet was formed. The water from your faucet could contain molecules the dinosaurs drank.**

# Welders, Cutters and Welding Machine Operators

**Do you have good eyesight and eye-hand coordination?**

**Can you concentrate on detailed work for long periods of time?**

**Are you adaptable?**

If you wanted to fasten together two pieces of paper, you'd use glue or staples. If you wanted to fasten together two pieces of cloth, you'd use a needle and thread. But what do you do if you want to join two pieces of metal?

Welding is the most common way to join metal parts permanently. When you drive a car, walk into a school building or turn on the water, you're benefiting from the work of welders.

## What's It All About?

Welders apply heat to the pieces of metal that are to be joined together, melting and fusing them to form a permanent bond. Their work is essential in the construction and repair of ships, automobiles, spacecraft and thousands of manufactured products. Welding is used to join the beams in buildings, bridges and other structures. It joins pipes in pipelines, and it's used in the construction of nuclear power plants and oil refineries.

Welders usually plan work from drawings or specifications. They also may analyze damaged metal parts. They select and set up the equipment they need to do the job. They examine their welds to make sure they meet standards or specifications.

On some jobs, all welding is done by hand. Welders use hand tools and control the job from start to finish. Other jobs are semi-automated—welders use machinery, such as a wire feeder, to help perform their tasks.

In some cases—especially where the job is repetitive and the items to be welded are relatively uniform—automated welding is used. A machine does the welding and the welding machine operator supervises the work. *Welding machine operators* need to know how to set up and operate the machines as specified by the layouts, work orders or blueprints.

Some welders have limited responsibilities. They do routine production work that has already been planned and laid out. Their jobs do not require knowledge of all welding techniques.

*Arc, plasma and flame cutters* have job that are similar to that of a welder and use similar types of machinery on the job. But instead of joining metals together, they use the heat from burning gases or an electric arc to cut and trim metal objects to a specific size. Cutters also are used to dismantle large objects—ships, railroad cars, automobiles and aircraft.

Most welders and cutters—about nine out of 10—work in manufacturing, services, construction or wholesale trade. Most of those in manufacturing work with transportation equipment, industrial machinery and equipment or fabricated metal products. All welding machine operators work in manufacturing industries—primarily fabricated metal products, machinery and motor vehicles.

## Job Outlook

The total number of jobs for welders, cutters and welding machine operators is expected to increase by 7 percent, to 485,000, by 2006.

## What's It Really Like?

"One of the advantages of the welding field," says Dusty, a career welder, "is the diversity of opportunities. Depending on your aptitude, interests and experience, you can pursue welding engineering, welding technician, construction, fabrication, plant maintenance and repair, pressure vessel [pipe] welding, job shop, underwater salvage—even operate your own business."

This can be a dangerous job. Welders and cutters wear safety shoes, goggles, hoods with protective lenses and other protective clothing. They must take these precautions because there is real potential for on-the-job injuries—for example, burns, eye injuries and injuries from falling objects. Some metals give off toxic gases and fumes as they melt. Welders who operate automated welding machines are not exposed to as many hazards and need only wear a protective face shield or goggles.

Welders often have to work in awkward positions, making welds while stooping, bending or working overhead. You're likely to get dirty on the job, since the metal surfaces you're working with may be covered with grease, dirt or rust. On some jobs, you may be isolated while you work in a booth built to contain sparks and glare. In some settings, though, the working conditions are much better and there are few discomforts.

While you can earn a good living as a welder, the availability of work can be unpredictable. If the economy slows down you may be laid off. On the other hand, during upturns you may need to work overtime to finish a particular job.

## How Do I Get a Job and Advance?

Welders need good eyesight, excellent eye-hand coordination and manual dexterity. They also must be adaptable, since they are likely to be cross-trained for other production jobs.

Training for welders can range from a few weeks of school or on-the-job training for basic positions to several years of combined school and on-the-job training for highly skilled jobs. You can take welding in high school, vocational schools, vocational-technical institutes, community colleges and private welding schools. You also can learn this trade in the military, and some employers provide on-the-job training.

Take courses in blueprint reading, shop mathematics, mechanical drawing, physics, chemistry and metallurgy if you can. As with most jobs, a knowledge of computers is becoming more important, especially for welding machine operators. Some welders are responsible for programming computer-controlled welding machines, including robots.

You can be certified as a welder. Your employer will send you to a technical school or an independent testing lab. There, you'll weld test specimens to the specific codes and standards required by your employer. If the welding inspector determines that your work meets the guidelines, he or she will certify that you are able to perform a particular welding procedure. Certified welders, especially those who are certified in more than one process, have better job opportunities than their noncertified counterparts.

Welders can advance as they gain experience and skill. Advancement is usually to such jobs as welding technician, supervisor, inspector or instructor. Some experienced welders go into business for themselves.

Much of the welding done in manufacturing is being automated, but there still will be a significant demand for welders in other areas. There will be job openings for manual welders, especially those with a wide range of skills. They'll be needed for sophisticated fabrication tasks and repair work that cannot be automated. The aging of our nation's roads, bridges and other infrastructure also will create job opportunities for welders.

## How Much Money Will I Make?

The average salary for welders and cutters is about $25,000. The top 10 percent in salary earn more than $40,000. More than one in four welders is a union member.

## To Learn More

For information on careers in welding, contact the American Welding Society, 550 N.W. Lejeune Road, Miami, Fl 33126 (www.am.weld.org).

For a list of accredited schools that offer training in welding, write the Career College Association, 750 First St NE, Suite 900, Washington, DC 20002.

### Did You Know?

**Nearly** two of five welders **in this** country are employed in just six states: **Texas,** California, Ohio, **Pennsylvania,** Michigan **and** Illinois. These states **have** large concentrations **of** jobs in automobile and **other** fabricated metal **products** manufacturing, **and** in the petroleum and **chemical** industries.

# Mechanics, Installers and Repairers

# Electronic Equipment Repairers

**Do you like to figure out why something isn't working and fix it?**

**Do you have an understanding of electronics?**

**Do you have good eyesight and keen hearing?**

When a friend's CD player won't work, are you the person who gets asked to take a look at it? Do your friends' parents call you to come over and program their VCR? Do you get extra credit in English class because you know how to make the film projector work when your teacher doesn't have a clue?

As an electronic equipment repairer, you could get paid for doing those things. There's plenty of work for people who know how to service and repair the electronic equipment used in homes and businesses.

## What's It All About?

Electronic equipment repairers install, maintain and repair the electronic equipment used in offices, factories, homes, hospitals, aircraft and other places. The equipment they repair includes television, radar, industrial equipment controls, telephone systems and medical diagnosing equipment.

Also known as service technicians or field service representatives, people in this job install, test, repair and calibrate equipment to make sure it works properly. They also keep detailed records on each piece of equipment to provide a history of tests, performance problems and repairs.

If you're looking for independence, you can find it by working as a field repairer. Many spend nearly all of their time in customers' businesses. "I love the independence," says one repairer. "I check in for half an hour in the morning and in the evening, and I'm out on my own all day long. I have a company van and no boss looking over my shoulder." Of course, if you're spending that much time in your customers' businesses, you'll need people skills as well as knowing how to repair the equipment.

Or, you can work in a fully equipped shop in a store, factory, service center or repair facility as a bench repairer. You'll repair equipment that customers bring to you, or that field repairers have brought in for service.

Because electronic technology is getting more and more complex, most technicians specialize in a particular type of equipment. It's a constantly changing field, so you must update your knowledge and skills regularly, often on your own.

## What's It Really Like?

You'll enjoy this job if you like hands-on work in electronics. You need to be a logical thinker who enjoys problem solving, and you need to be a stickler for detail.

The job involves detective work. When a machine first breaks down, you need to figure out what the problem is. Sometimes the answer is pretty obvious —a loose connection or a defective component, for example. More often,

## Job Outlook

**The number of jobs in the field is expected to increase by about 5 percent, to 144,000, by 2006. There will be a decline in repair jobs for home entertainment equipment because technology is making those items more reliable and easier to service. There will be an increased need, however, for people to repair commercial and industrial equipment.**

though, you'll have to dig deeper to find out what's wrong. The answer may lie in a review of your maintenance records or the customer's previous work orders, which provide a record of past repairs. Sometimes talking to the people who use the machines offers clues.

If none of those things work, you may need to refer to schematic drawings or manufacturers' specifications that show connections and offer instruction on how to locate problems. You may use such tools of the trade as a voltmeter, an ohmmeter, a signal generator, an ammeter or an oscilloscope. More and more equipment has a self-diagnosing feature, which can make the job of a repairer a little easier. Once you figure out what's causing the problem, you'll advise customers whether it's better to purchase a replacement part and fix the old machine or to buy a brand new one.

Some electronic equipment repairers work shifts, including weekends and holidays. The most senior employees usually get the best shifts. You also may need to come in to work if there's an equipment failure.

To do this job you must be trustworthy because you may be exposed to money and other valuables in banks, securities offices and other places where you'll make repairs. In fact, you may need to be bonded before working at some jobs.

You'll need good eyesight to inspect and work on small, delicate parts in various colors. You'll also need excellent hearing, since some malfunctions are detected by sound. You should be physically strong as well, since the work involves lifting, reaching, stooping, crouching and crawling. And you must pay special attention to safety or you may sustain minor burns or electrical shocks.

This job may be less affected by economic downturns than others. "Even when times are tough, this is a good business to be in," says Al, an electronic equipment repairer. "People use older equipment so there are more calls for us than ever."

## How Do I Get a Job and Advance?

Most employers prefer to hire applicants who have completed a one- to two-year training program in electronics. Many community colleges and vocational schools offer this training. You also can get the training you need in the military.

You'll study mathematics, physics, electricity, electronics and troubleshooting. You'll learn how to read schematic drawings. You'll also need to choose some courses that will prepare you for a specialty—for example, commercial and industrial equipment or home entertainment equipment.

Any electronics technician may take the Electronics Technicians Association's certification exam. Typically, technicians interested in certification work in the commercial or government sector; for an electronics retailer/distributor or an independent service and support organization; are shop owners, educators or independent consultants; or are military personnel.

Both the International Society of Certified Electronics Technicians and the Electronics Technicians Association administer certification programs. A technician, electronics student or electronics technician with less than two years of work and/or electronics training may apply for the associate exam. This multiple-choice test covers basic electricity, electronics, math, AC and DC circuits, transistors and basic troubleshooting skills. Associate certification is good for two years.

After you're hired, you'll probably receive some training from your employer. You may study electronics and circuit theory and math. You'll also get hands-on experience with equipment, doing basic maintenance or using diagnostic equipment to locate malfunctions. The training may be in a classroom or it may be self-instruction—combining computer software, videotapes and workbooks that let you work at your own pace.

One way to advance is by continuing to upgrade your certification. Once you have four years of experience you can earn certification in such areas as industrial and commercial equipment, audio, avionics, wireless communication, video distribution, satellite and radar systems repair.

You also may advance by becoming a troubleshooter—someone who handles the toughest problems and offers advice to other repairers. Some repairers open their own repair services or shops or become wholesalers or retailers of electronic equipment. Because they know the equipment so well, some repairers become manufacturers' sales workers. Those interested in leadership positions may get a job as a maintenance supervisor or a service manager.

## How Much Money Will I Make?

The average salary for full-time electronic equipment repairers is $32,000, but earnings can be much higher. The top 10 percent of people in this field earn $50,000 a year.

## To Learn More

For information on certification, or for career information, contact the Electronics Technicians Association, 602 N. Jackson, Greencastle, IN 46135; (765) 653-4301 (www.etasda.com/index.html). This site also has links to other electronics sites on the Web.

Certification information also is available from the International Society of Certified Electronic Technicians, 2708 W. Berry St., Fort Worth, TX 76109; (817) 921-9101 (www.iscet.org/info.html).

### Did You Know?

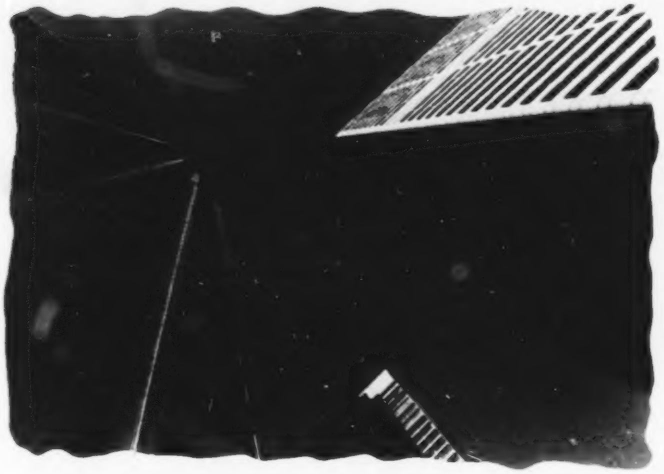
Electronic equipment repairers must be able to recognize even slight differences in color.

# Elevator Installers and Repairers

**Are you mechanically inclined?**

**Are you methodical?**

**Are you extremely safety conscious?**



What would the New York City skyline be without skyscrapers? Well, there could be no skyscrapers without elevators. And there'd be no elevators without the people who know how to install and maintain them.

If you're mechanically inclined, physically fit and safety conscious, you might go for this job—one that, quite literally, will help you move up in the world.

## What's It All About?

Elevator installers and repairers assemble, install and replace elevators, escalators, dumbwaiters (which are small elevators that convey items from one floor to another—not clueless serving people!), moving walkways, wheelchair lifts and similar equipment. Once the mechanisms are in place, installers make sure they stay in working order. Most important, installers ensure the equipment operates safely.

If you're installing an elevator in a new building you'll start with an open shaft the building's full height. You'll need to know how to read blueprints so you can determine the layout of the framework to install such elements as rails, machines, car enclosures, motors, pumps, cylinders and plunger foundations. While working on scaffolding or platforms, you'll bolt or weld steel rails to the walls of the shaft to guide the elevator up and down.

Then you'll install the hoisting machinery and equipment, counterweights, car platforms and the chassis of the elevator or escalator. Next, you'll use hand and power tools to build the elevator car frame. The frame is attached by cable to the counterweight, which moves in the opposite direction from the car and facilitates its swift, smooth movement. You'll also install the outer doors and door frames at the elevator entrances on each floor.

Safety is the most important responsibility of an elevator installer or repairer. "People's safety depends on my skill," says one elevator installer. "If I make a mistake, it could cause an accident." You can't take risks or overlook details in this job. If a problem occurs, you must deal with it as quickly as possible.

Once the elevator is installed you must do the maintenance and repair work that will keep it running safely. You'll keep an up-to-date log book that outlines all the repairs and checks you've performed on the elevator so anyone who works on it will know exactly what you've done. Usually you'll do preventive maintenance—such as oiling and greasing moving parts, replacing worn parts, testing equipment with meters and gauges, and adjusting equipment for optimal performance. You also may troubleshoot and might be called in to do emergency repairs.

Because the vast majority of modern elevators are electronically controlled,

## Job Outlook

An 8 percent increase in the number of jobs, to 27,000, by 2006. The job outlook in your area could be better or worse mostly depending on the level of new construction. Job prospects should be best for those with training beyond high school in electronics or with more advanced formal education.

elevator installers and repairers need to be knowledgeable in electronics, electricity and hydraulics. Although electronic devices help keep track of speeds, weights or heights, you still need to know how to make those calculations on your own.

For major repairs—for example, replacing cables, elevator doors or machine bearings—you'll work as part of a service crew. This may require using cutting torches or rigging equipment—tools a maintenance mechanic would not normally carry. Service crews also do major modernization and alteration work, such as moving and replacing electrical motors, hydraulic pumps and control panels.

## What's It Really Like?

There's a lot of variety to this work, and every job is different. As an elevator installer and repairer, you will:

- Read and interpret blueprints to determine the layout of system components.
- Install elevators, escalators, moving walkways, dumbwaiters and related equipment according to specifications.
- Install and wire electric control system devices.
- Install, test and adjust safety-control devices.
- Test operation of newly installed equipment.
- Troubleshoot electrical or mechanical systems failures.
- Disassemble defective units and repair or replace worn or suspect parts.
- Adjust valves, ratchets, seals, brake linings and other components.
- Carry out preventative maintenance programs to ensure public safety.

Most elevator installers and repairers specialize in installation, maintenance or repair work. Maintenance and repair workers need greater knowledge of electricity and electronics because a large part of their job is troubleshooting.

Most elevator installers and repairers work a 40-hour week. Maintenance and service mechanics often work overtime, however, when repairing essential elevator equipment. They sometimes are on 24-hour call. Maintenance mechanics, unlike most elevator installers, are on their own most of the day and typically service the same elevators periodically.

The work is physically challenging. You'll lift and carry heavy equipment and parts and may work in cramped spaces and be forced to assume awkward positions. Because you'll handle heavy equipment, you may experience muscle strains or other injuries. Falls and electrical shocks are also a danger.

Although you're part of the construction industry, as an elevator installer and repairer you'll have more job security than other workers in that field. Since you'll work indoors in buildings under construction or in existing buildings, you'll lose less work time because of bad weather than will other building trades workers. And even if there's an economic downturn, you're likely to keep working because elevators and other equipment must always be kept in working condition. The need for people to service elevators and escalators should increase as equipment becomes more intricate and complex.

## How Do I Get a Job and Advance?

To become an elevator constructor you must be a high school graduate or have earned a GED. High school classes in electricity, mathematics and physics are very helpful. Education in electronics is a major plus. Electrical and mechanical experience will come in handy. You also must also be in good physical condition.

Most installers and repairers apply for their jobs through a local chapter of the International Union of Elevator Constructors. You'll learn your trade on the job, but there also will be classroom instruction in electrical and electronic theory, mathematics, applications of physics and safety.

It takes four to five years before you can be certified as a fully qualified mechanic. You'll need to pass a written exam. Most states and cities also require you to pass a licensing exam. But because of the need to keep updated on the latest technological advancements, you'll probably need to undergo some type of training over the course of your entire career.

You may receive further training in a specialized area and advance to being a mechanic in charge, an adjuster, a supervisor or an elevator inspector. Adjusters are highly skilled elevator installers and repairers who specialize in fine-tuning all the equipment after installation. Adjusters must make sure the elevator is working according to specifications, such as stopping correctly at each floor within a specified time period.

## How Much Money Will I Make?

The average salary for elevator installers and repairers is $43,800. There is some geographic variation in wages.

## To Learn More

For more information, contact the International Union of Elevator Constructors. Although IUEC does not have a Web page, there is a link to all local chapters at www.ecis.com/~sandc-/iuec/iuecmail.shtml.

For general information on a career as an elevator installer and repairer, visit the Career Net site on the Web (http://job.careernet.org/elevate.htm).

### Did You Know?

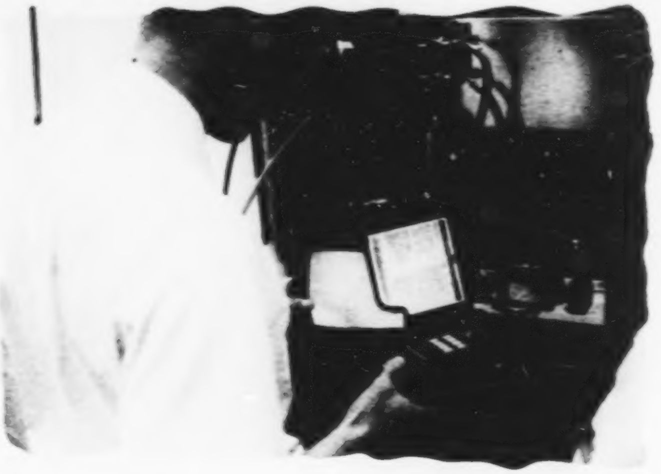
**About 80 percent of elevator installers and repairers are union members—a greater percentage than that of nearly any other occupation.**

# Heating, Air-Conditioning and Refrigeration Technicians

**Do you like to work with tools?**

**Could you keep your cool with angry customers?**

**Are you in good physical condition?**



The baby's medication must be kept cool. A senior citizen with a heart condition has been ordered to stay in a warm room. The meat you just brought home from the grocery store must be stored in a cold place at once to avoid the formation of harmful bacteria.

Heating, air-conditioning and refrigeration technicians help make those things happen. They install, maintain and repair the technology that controls the environment in any enclosed area—from a home to a space capsule. The know-how to install and maintain special environments for people, products and perishables is essential to our lives.

## What's It All About?

Heating and air-conditioning systems control temperature, humidity and total air quality. In homes and schools, in office buildings and sports arenas, in shopping malls, ships and boats—in fact, in almost any structure where people live, work or play—you'll find heating, air-conditioning and refrigeration technicians at work.

The systems that keep our environment hot or cool consist of many mechanical, electrical and electronic parts. These include motors, compressors, pumps, fans, ducts, pipes, thermostats and switches. Those in the trade —often called HVAC (heating, ventilating and air conditioning) technicians—must be able to maintain, diagnose and correct problems anywhere in the entire system.

Although technicians are trained in both installation and repair of HVAC systems, they often specialize in one or the other. Some specialize even further—for example, one technician may be an expert on installing solar panels, while another knows everything about commercial refrigerators.

*Furnace installers*, also called heating equipment technicians, install oil, gas, electric, solid-fuel and multiple-fuel heating systems. They read blueprints to see where the equipment goes. Then they install the fuel and water supply lines, air ducts and vents, pumps and other components.

*Air-conditioning and refrigeration technicians* install and service central air-conditioning systems and a variety of refrigeration equipment. They follow blueprints, design specifications and manufacturers' instructions to install motors, compressors, condensing units, evaporators, piping and other components. They fill the system with refrigerant and check it for proper operation.

If equipment breaks down, technicians need to figure out what's wrong and then repair it. They also perform routine maintenance to keep the equipment running safely. During the off season they may do maintenance work that requires the system to be shut down.

Environmental concerns have added

## Job Outlook

**A 17 percent increase, to 300,000 jobs, by 2006. The supply of trained technicians has not kept pace with demand for many years. New technology and new products that require refrigeration or special environments create new needs and jobs every day.**

new duties to technicians' jobs. They are responsible for conserving, recovering and recycling chlorofluorocarbon (CFC) and hydrochlorofluorocarbon (HCFC) refrigerants. When these chemicals are released into the atmosphere they are thought to contribute to reduction of the ozone layer—the layer of atmosphere that protects people, plants and animals from ultraviolet radiation.

To contain these potentially harmful chemicals, technicians make sure there are no leaks in a system when they install it. They recover CFCs and HCFCs by venting them into proper cylinders. Later, they recycle these refrigerants for reuse with special filter-dryers.

On the job, technicians use a variety of tools, including hammers, wrenches, metal snips, electric drills, pipe cutters and benders, measurement gauges and acetylene torches. They also use voltmeters, thermometers, pressure gauges, manometers and other testing devices to check air flow, refrigerant pressure, electrical circuits, burners and other components.

## What's It Really Like?

You could find yourself working on the space shuttle or in an elementary school. You might work alone or with a team, create with both your hands and your head, work indoors or outdoors, travel or stay in an office, work for others or be your own boss in your own business.

You may be asked to work outside in cold or hot weather. You may need to work in a building that is bitterly cold because the heat isn't working—or one that's swelteringly hot because the air conditioner is out of order. After all, you're the one who is responsible for getting the system back in working order.

"On the first hot day of the summer, I have to deal with a lot of hot, angry people," says Ed, who runs his own HVAC service business. "But it's satisfying to leave them cool and smiling when I walk out the door."

Besides angry customers, there are other hazards in this job. You may be required to work in an awkward or cramped position, or in high places. You may face possible electrical shocks, burns, or other injuries from handling heavy equipment.

You'll need to take special precautions if you handle refrigerants. Contact can cause skin damage, frostbite or even blindness. If you inhale refrigerants when working in a confined space you could be asphyxiated.

Most technicians work a 40-hour week, but some overtime may be required. You may be on call for emergencies some evenings or weekends. The work is usually stable, especially if you work for a company that does both heating and air-conditioning work.

## How Do I Get a Job and Advance?

A high school education is essential. Take as many classes as you can in applied math and physics. Knowledge of blueprint reading and computer applications also are helpful, as is basic knowledge of plumbing and electrical work. Familiarity with electronics is becoming increasingly important, since much of today's HVAC technology uses solid-state equipment controls.

Vocational-technical schools, private trade schools and junior colleges offer programs in heating, refrigeration and air conditioning. You also can learn this trade in the military. These programs may last from six months to two years. You'll study cooling and heating components and applications, basic electricity, commercial refrigeration and basic maintenance.

You also can enroll in an apprenticeship program sponsored by local chapters of industry trade associations. These usually last three or four years and combine on-the-job training with classroom instruction.

Any technician who works with CFCs and HCFCs must be certified through an organization approved by the federal Environmental Protection Agency. Certification involves passing a written examination that is specific to the kind of work performed: Type I is for small/home appliances, Type II is for high-pressure equipment, Type III is for low-pressure equipment and Universal is for all types of equipment.

Some technicians become supervisors or service managers, while others start their own business.

## How Much Money Will I Make?

The average wage for heating, air-conditioning and refrigeration technicians is $27,900. Apprentices usually earn about 50 percent of what experienced workers do. The top 10 percent in salary earn an average of $46,100.

## To Learn More

For information on training opportunities and careers in the field, contact:

The Air-Conditioning & Refrigeration Institute, 4301 N. Fairfax Drive, Suite 425, Arlington, VA 22203; (703) 524-8800 (www.ari.org/coolnet.html).

Associated Builders and Contractors, 1300 N. 17th St., Arlington, VA 22209 (www.abc.org).

The National Association of Plumbing-Heating-Cooling Contractors, 180 S. Washington St., P.O. Box 6808, Falls Church, VA 22046; (800) 533-7694 (www.naphcc.org).

Contact your local schools or state department of education for lists of training programs.

### Did You Know?

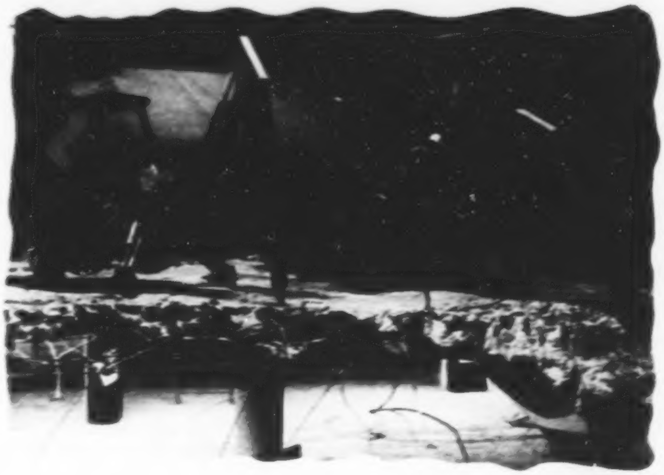
**Nearly half the products sold in a typical convenience store require some refrigeration.**

# Mobile Heavy Equipment Mechanics

**Do you like to work with tools?**

**Can you learn new skills quickly?**

**Do you want to work on huge machinery?**



You were the kid who read *Mike Mulligan and His Steam Shovel* over and over. And, just like Mike, you want to know how one keeps those huge pieces of construction equipment running.

A career as a mobile heavy equipment mechanic may be for you. These skilled mechanics repair and maintain the engines, transmissions, hydraulics and electrical systems that power graders, backhoes and stripping and loading shovels.

## What's It All About?

Many industries—construction, logging and mining, for example—depend on heavy machinery. When a large, expensive piece of equipment breaks down, work may have to be called off, costing thousands of dollars in lost productivity. Keeping those huge machines in good working order is the responsibility of mobile heavy equipment mechanics.

To keep breakdowns to a minimum, these mechanics spend much of their time performing routine and preventive maintenance. They check diesel engines, transmission systems and brakes to make sure the equipment is operating safely. These checks, plus feedback from equipment operators, usually give mechanics a pretty good idea what problems must be addressed.

Mobile heavy equipment mechanics also can use a variety of diagnostic equipment to help identify problems. On the newest heavy equipment, a mechanic can simply plug a hand-held computer into an on-board computer. The readout will tell the mechanic what needs to be adjusted or repaired.

Once the problem is pinpointed, mobile heavy equipment mechanics are responsible for fixing it as quickly as possible. They may need to take a component apart to see if parts show damage or excessive wear. Then, using hand-held tools, the mechanic repairs, replaces, cleans and lubricates the parts, puts them back together, tests everything for safety and reinstalls the component in the machinery.

Many types of mobile heavy equipment rely on hydraulics (liquids operating under pressure) to raise or lower movable parts—scoops, shovels, log forks, scraper blades and so on. Even a tiny leak can cause these machines to lose power. So mechanics need to look for ruptured hoses, worn gaskets or other fluid leaks that may prevent the equipment from operating as it should. Occasionally, they may need to replace a hydraulic pump or perform other major repairs.

Sometimes mechanics specialize in one or two types of repair—such as engine repair, transmissions, electrical systems or brake systems. As equipment becomes more sophisticated, mechanics need more specialized knowledge.

## Job Outlook

**A 6.5 percent increase, to 111,000 jobs, by 2006—with opportunities particularly good for those completing formal training programs in diesel or heavy equipment mechanics. Employment is linked to the nation's economic cycles, however, with more construction activity (and thus more demand for heavy equipment) during boom times.**

Those who understand electronics and electronic components are much in demand.

What happens when construction equipment breaks down at a job site? It may be too expensive or difficult to bring it back to the shop for repairs. In that case, an experienced mechanic may drive a specially equipped truck to the job site to make repairs.

## What's It Really Like?

Typically, mobile heavy equipment mechanics work for large organizations that own and operate their own heavy equipment, such as mobile heavy equipment dealers and construction contractors. Mechanics in smaller shops usually are responsible for most routine maintenance. More difficult repairs, like rebuilding or replacing engines, correcting electrical problems or repairing hydraulic fluid pumps, are likely to be done in a large shop, especially one run by a mobile equipment dealer.

You need to be familiar with many different types of tools. You'll use pneumatic wrenches to remove bolts quickly. Jacks and hoists lift and move large parts. Lathes and grinding machines are helpful in rebuilding brakes. Welding and flame-cutting equipment is useful when a mechanic is working on an exhaust system. Mechanics also use hand tools—screwdrivers, pliers and wrenches—to work on small parts.

Other specialized equipment is used in diagnostics. Tachometers and dynamometers can help locate engine malfunctions. Ohmmeters, ammeters and voltmeters are useful for working on electrical systems.

As with other mechanical jobs, mobile heavy equipment mechanics usually own their own hand tools. Some senior mechanics may have thousands of dollars invested in their tools. Employers usually provide the expensive power tools, computerized engine analyzers and other diagnostic equipment, however.

This is a hands-on occupation. Most mechanics work indoors in clean, heated and well-ventilated shops. Still, the parts you handle are greasy and dirty, and you'll probably get that way a lot of the time. If you follow safety procedures you can avoid major accidents. But nicks, cuts and minor burns are common. You should be prepared to stand or lie in awkward positions as you work on hard-to-reach places.

## How Do I Get a Job and Advance?

Some people come to this field through years of on-the-job training. But most employers are looking for people who have had some diesel heavy equipment mechanic training after high school. Many community colleges and vocational schools offer progra [illegible] diesel mechanics or automotive [illegible] Some, however, have developer [illegible] grams especially for heavy equi[illegible]t mechanics.

In a formal training program, you'll learn the basics of analyzing and diagnosing what's wrong. You'll learn how to operate the computers and other diagnostic equipment that can help you figure out the problem with a piece of equipment. And, of course, you'll learn how to repair each part, from the brakes to the hydraulics to the engine. Training in electronics is essential.

Usually, beginners start by performing routine service tasks. After they master repairing and servicing diesel engines they learn how to work on other components—brakes, transmissions and electrical systems. It may take four years of on-the-job experience before you are fully qualified to work on all types of heavy equipment.

Even after you're hired, your education will continue. Most employers send mechanics to training sessions to learn more about how to repair specific types of equipment.

You can be certified by the National Institute for Automotive Service Excellence in one of six areas: brakes, gasoline engines, diesel engines, drive trains, electrical systems and suspension and steering. Candidates must pass a written examination and have at least two years of experience, although graduates of a training program can substitute education for part of the experience requirement.

Experienced mechanics can advance to field service jobs, where they have a chance to tackle problems independently and earn more money. Others become shop supervisors or service managers. Some open their own businesses.

## How Much Money Will I Make?

The average salary for a mobile heavy equipment mechanic is about $31,800. The top earners make more than $50,000 annually.

## To Learn More

For general information about a career as a mobile heavy equipment mechanic, contact the Equipment Maintenance Council, 2020 Lake Shore Court, Sanger, TX 76266 (www.coneq.com); or the Specialized Carriers and Rigging Association, 2750 Prosperity Ave., Suite 620, Fairfax, VA 22031 (www.scranet.org).

For information on certification as a heavy-duty diesel mechanic, contact the National Automotive Technicians Education Foundation, 13505 Dulles Technology Drive, Herndon, VA 22071 (www.ascert.org). For a directory of public training programs for mobile heavy equipment mechanics, contact the Vocational Industrial Clubs of America, P.O. Box 3000, 1401 James Monroe Highway, Leesburg, VA 22075 (www.vica.org).

### Did You Know?

**One of the world's largest mining shovels weighs more than 1 million pounds. It has a capacity of 33 cubic yards—imagine scooping out a pile of dirt as long and wide as a football field in a single bite. The price? Just under $5 million.**

# Professional Services

# Designers

**Are you creative and imaginative?**

**Are you self-disciplined enough to work independently most of the time?**

**Do you enjoy solving problems?**

It's been called the biggest mistake in automotive history. In 1958, the Ford Motor Company introduced a new car with all the features customers said they wanted. The company planned to sell more than a million of them. They were so confident of the car's success that they named it after Henry Ford's only son, Edsel.

There was just one problem: The Edsel was ugly. American consumers wouldn't buy it. Within two years, the company took it off the market.

The story of the Edsel reflects the importance of design in today's world. Consumers are looking for more than utility. They want products that are visually appealing. Whether they apply their talents to clothing lines or cars or furniture, designers make sure products are attractive as well as practical.

## What's It All About?

Designers influence nearly every aspect of our lives. There are many different specialties within the design field. Some of the most common are:

*Fashion designers.* They design clothing and accessories. Fashion designers in places like Paris, Milan and New York bring out a "line" of clothing several times a year. These collections offer previews of what will be in stores the following season—the colors, skirt lengths, lapel widths and other details that will be seen in magazines and on department store clothing racks. Many of these fashion designers are famous—for example, Tommy Hilfiger and Donna Karan. Many other fashion designers don't put their names on their clothing and aren't famous at all. They work for clothing manufacturers and are the people who ultimately decide whether you can buy a green T-shirt at your favorite mall store.

*Interior designers.* They plan the space and furnish the interiors of offices, homes, public buildings and other commercial establishments. This may mean doing everything from choosing the basic color scheme of an office to deciding where the photocopying machines should be placed so their noise doesn't interfere with people's work. One of the most important jobs of interior designers today is making sure spaces meet local building codes (no matter how elegant the silk fabric is, if it doesn't meet fire code requirements, the client can't put it on the walls) and laws making all public places accessible to people with disabilities.

*Industrial designers.* This type of designer works with countless manufactured products. They're the people who combine market research with design savvy to give products their identifiable "look." Home appliances; cars; children's toys; computer equipment; and medical, office or recreational equipment are all designed by industrial designers.

### Job Outlook

**A 26 percent increase, to 431,000 jobs, by 2006. A continued emphasis on product quality and a growing emphasis on fashion and style should keep the market for designers in all fields strong. Floral design will see job growth as many grocery stores and department stores add floral departments.**

*Set designers.* They work in the movies, television and the theater. They design the backdrop that creates the overall atmosphere for the play or show.

Other specialties in the design field include *furniture design, floral design* and *textile design.* Most designers specialize in a particular area, such as clothing or cars. But sometimes successful designers branch out to several design fields—think of Ralph Lauren, who now has his name on complete lines of not only men's and women's clothing but home furnishings as well.

## What's It Really Like?

Designers start any design process by learning about the client's needs. Typically they hold many meetings with their client, offering suggestions and listening to what the client wants. This process holds true whether the designer is placing flowers for a wedding or designing the interior of a corporate headquarters.

The budget has to be considered very carefully. Helen, an interior designer who specializes in health care facilities, says, "No matter how great my design, if the client can't afford it, I haven't done my job." Budget considerations are important in other types of design as well—a fashion designer who is creating a shirt for the mass market had better not propose a garment that costs $150 to manufacture.

Sometimes designers make a model, prototype or detailed plans, drawn to scale. In some specialty areas, designers rely heavily on computer-aided design (CAD) tools to get a real idea of what the finished product will look like.

People in this field need a strong sense of color, an eye for detail, a sense of balance and proportion and sensitivity to beauty. They also need to be good communicators—the best ideas in the world are unlikely to become reality if the designer can't communicate with the client.

Although designers usually work regular hours, they often face deadline pressure that lengthens their workdays. Even when they're not in the office, they may be trying to solve a problem. "I can get an idea for a job anywhere," says Helen, "so in a sense I'm always working."

The most frustrating part of the job may come when the designer shows her work to the client or to the public. Not every design is popular (somebody thought the Edsel was attractive). Sometimes clients just don't like the look a designer has proposed. Sometimes the designer has to scale back his or her creativity to adapt to the realities of the client or the market.

## How Do I Get a Job and Advance?

People interested in floral design can get a job right out of high school. Most other design fields require some additional training. Fashion design, for example, requires a two- or four-year degree that covers such subjects as textiles, fabrics and trends in the fashion world. Industrial design generally requires a four-year degree.

Interior design is the only design field subject to government regulation. In 22 states, interior designers must be licensed. Most interior designers have a four-year degree.

In addition to art programs at colleges and universities, many designers graduate from formal schools of art and design. Today, there are about 200 of these institutions throughout the country.

The computer is becoming an integral design tool, so knowledge of computers and CAD is essential in almost any design field. Besides your formal training, you'll need to assemble a portfolio showing your best design work. A good portfolio is often the deciding factor in getting a job.

Beginning designers usually receive on-the-job training in addition to their formal education. Designers may advance to becoming chief designer, design department head or other supervisory positions. Others decide to strike out on their own and open their own design firm.

## How Much Money Will I Make?

The average salary for designers in all specialty areas is $30,600. Floral designers typically earn significantly less—about $17,000 per year. Industrial designers typically earn more—senior designers with eight years experience can expect to earn about $45,000.

## To Learn More

For a list of accredited programs in interior design, contact the Foundation for Interior Design Education Research, 60 Monroe Center NW, Grand Rapids, MI 49503 (www.fider.org).

For information about careers in floral design, contact the Society of American Florists, 1601 Duke St., Alexandria, VA 22314; (703) 836-8700 (www.aboutflowers.com).

For information on industrial design, contact the Industrial Designers Society of America, 1142-E Walker Road, Great Falls, VA 22055 (www.idsa.org).

For information on interior design, contact the American Society for Interior Designers, 608 Massachusetts Ave. NE, Washington, DC 20002 (www.asidnews.com). For a list of interior designers in your area, use ASID's referral service at www.interiors.com.

### Did You Know?

**Nearly four out of 10 designers are self-employed, compared to fewer than one out of 10 workers in all occupations.**

# Paralegals

**Can you communicate your ideas clearly, both orally and in writing?**

**Do you like doing research?**

**Do you have good computer skills?**

You've grown up watching *Law and Order* on TV. John Grisham's courtroom thrillers are your favorite books. But you don't want to spend three years after college going to law school—and you're not interested in 80-hour work weeks.

A career as a paralegal may be the perfect solution. Paralegals perform many of the same tasks as lawyers, except for those considered to be the practice of law.

## What's It All About?

Not all legal work requires a law degree. Paralegals (the term is preferred over "legal assistants") work for lawyers. Many of the responsibilities of a lawyer may be delegated to a paralegal. They may be asked to:

- Interview and maintain contact with clients, as long as this is done under the supervision of an attorney.
- Locate and interview witnesses.
- Conduct legal research.
- Draft legal documents, correspondence and pleadings.
- Summarize depositions, interrogatories and testimony.
- Conduct investigations and statistical and documentary research.
- Write and sign correspondence, as long as it doesn't include independent legal opinions or legal advice.

There are some things paralegals are not allowed to do. They cannot give legal advice, represent a client in court, set a fee or accept a case. When communicating with the public or a client, paralegals must make it clear that they are not lawyers.

Still, it's an exciting job, especially for people who are interested in research and writing. Paralegals usually do the preparatory work for lawyers who are involved in trials, hearings, corporate meetings or real estate closings. Paralegals investigate the facts, making sure all the relevant information is available to the attorneys. They conduct legal research to identify the appropriate laws, judicial decisions, legal articles and other materials that apply to the case at hand.

If the attorney decides to file a lawsuit or go to trial, the paralegal may be asked to help prepare legal arguments. The paralegal may write drafts of pleadings and motions that will be filed with the court. He or she also organizes and keeps track of all the documents and correspondence important to cases and makes them available to attorneys.

## What's It Really Like?

The responsibilities of paralegals vary depending on where they work. If you were a litigation paralegal you would help attorneys get ready to take cases to court. That might mean interviewing

## Job Outlook

A 67 percent increase, to 189,000 jobs, by 2006. The U.S. Department of Labor predicts that this will be one of the fastest growing occupations in the economy.

witnesses, investigating facts or analyzing and digesting legal documents. You also would be responsible for managing the information to be used in trial preparation and would probably assist the attorneys during the trial.

If you were a government paralegal, you might work for the U.S. Justice Department, the Federal Trade Commission or perhaps even at the White House. You could be responsible for collecting evidence, analyzing legal material for internal use, maintaining reference files, doing research for attorneys, or collecting and analyzing evidence for agency hearings.

As a probate paralegal, you might interview clients, administer estate accounts or prepare tax returns. As a real estate paralegal, you might prepare for closings and research title or administrative processes involved in land and environmental use.

If you worked in a corporation, you might help attorneys with employee contracts, shareholder agreements and stock option and employee benefit plans. You also might help prepare and file annual financial reports, maintain corporate minute books and resolutions and help secure loans for the corporation.

Wherever you would work, you'd probably use computers. "Few professions are as information intensive as the law," says Kathleen, a paralegal. Whether paralegals are doing online legal research or using computerized databases to organize, index and retrieve material, technology skills are a must. A knowledge of spreadsheets, word processing and database management is especially helpful.

Most paralegals work a standard 40-hour week. As a big trial or hearing approaches, however, they may be asked to work very long hours to meet deadlines. Still, the number of hours required of a paralegal are significantly fewer than those for most attorneys.

Paralegals must be good at thinking logically. They need to be independent and self-directed. They have to possess excellent communications skills, both oral and written. They also should be good at conducting research. A familiarity with legal terminology is important as well.

## How Do I Get a Job and Advance?

There are several ways to become a paralegal. Most employers want to hire people with some formal training, although there are a few employers who are willing to promote legal secretaries or to hire college graduates with no legal experience.

A significant majority of paralegals—about 85 percent—have had some formal paralegal education. There are both two-year certificate and four-year degree programs. Training usually includes courses on the law and legal research techniques, as well as classes on specialized areas of the law such as real estate, estate planning and probate, litigation, family law, contracts and criminal law. Today, most programs also include coursework in legal applications of computers. Many programs feature an internship in a law office, since experience is helpful when seeking a job.

About half (53 percent) of paralegals have at least a bachelor's degree. A four-year degree is expected to become increasingly important as paralegals assume more and more responsibility.

Certification is not required, but there are two voluntary certification programs —one developed by the National Association of Legal Assistants and the other by the National Federation of Paralegal Associations. Completion of either of these voluntary certification programs may qualify paralegals for higher salaries and greater job responsibilities.

Advancement usually comes by taking on greater responsibilities. Senior paralegals may even be involved in the strategic side of legal work, meeting with clients and working closely with attorneys. Some paralegals also become supervisors and take on greater responsibilities for office management.

## How Much Money Will I Make?

The average salary for paralegals is $32,900, although pay varies greatly depending on education, training, experience, the type and size of the employer and the geographic location of the job. Nearly two-thirds of paralegals (64 percent) receive an annual bonus in addition to their salary—an average of about $2,100. In general, paralegals who work for large law firms or in large cities earn more than those who work for smaller firms or in less-populated areas.

## To Learn More

For information on a career as a paralegal, schools that offer training programs and standards and guidelines for paralegals, contact the National Association of Legal Assistants, 1516 S. Boston St., Suite 200, Tulsa, OK 74119 (www.nala.org).

Information on careers and training programs, and job postings for paralegals, are available by contacting the National Federation of Paralegal Associations, P.O. Box 33108, Kansas City, MO 64114; (816) 941-4000 (www.paralegals.org).

### Did You Know?

**Litigation** will continue to **be the legal** field that offers **the greatest** opportunities **to paralegals**. As attorneys **devote** most of their time **to developing** legal arguments and spending time **with clients**, they will **count** on paralegals to handle the increasingly technical side of preparing for a trial.

# School Teachers

**Can you inspire and motivate people?**

**Are you creative, patient and organized?**

**Do you want to make a difference in children's lives?**

The late educator and astronaut Christa McAuliffe may have said it best: "I touch the future—I teach."

Her words sum up what most teachers enjoy about their jobs. "There are other jobs that would pay me more money," says Kelly, an elementary school teacher. "But you can't put a price on the satisfaction I get every day from opening up the world to children."

Talk to any teacher and you're likely to hear the same words. Teachers do what they do because they enjoy spending time with students, because they have a strong desire to help other people and because they believe they make a difference.

## What's It All About?

"Every day," says Carol, a sixth-grade teacher, "I ask myself the same question. It's not, 'What will I teach?' but, 'How can I make sure my students learn?'" That comment reflects the reality of a teacher's job today: It's changed from being a "sage on the stage"—someone who lectured to a class of 25 or 30 students for an entire hour—to being a "guide on the side"—a coach who helps students learn to solve problems, apply what they've learned and communicate their findings to others.

Walk into any classroom or lab and you're likely to see students working individually or in small groups. Some may be doing independent research on the computer. Others may be conducting an experiment they'll later demonstrate to the class. Still others may be working with the teacher to learn a new skill. The teacher has planned all these activities and will be responsible for tracking every student's progress.

Most elementary school teachers spend their day with 20 to 30 students. They're responsible for making sure those students learn a variety of subjects—reading, math, English, social studies and science. In some schools elementary teachers also may be responsible for art, music, physical education and computers. In some cases two or more teachers work as a team.

At the secondary school level (middle, junior or high school), teachers usually specialize in one subject. They may teach a variety of courses within that subject—for example, a history teacher may teach U.S. history, American government and world history. Or, a teacher in a health occupations curriculum might teach practical nursing, personal care and CPR/first aid.

The teacher's most important responsibility is to design what goes on in the classroom. Teachers plan, evaluate and assign lessons for students. They measure how well students are learning the material—either by giving tests or by having students demonstrate their knowledge of the subject. They grade papers, prepare report cards and meet with parents and school staff. In addi-

## Job Outlook

**A 21 percent** increase, to 4.6 mil**lion jobs, by 2006.** There are **teacher shortages** in mathematics, **science (especially** chemistry and **physics), bilingual** education and **computer science.** There also is a **growing need** for special educa**tion teachers.**

tion to their work in the classroom, many teachers coach a sport or serve as an adviser to a school club or activity. Some also serve on school committees.

A growing number of states and school districts have given more power to local schools through site-based decision-making. In these schools, teachers and parents work together to decide a school's budget, hire staff, choose textbooks and design a curriculum to meet students' needs.

## What's It Really Like?

"The first time I closed the door to my classroom," says one veteran teacher, "I realized that I was pretty much on my own." Teachers do have a lot of independence—they're usually free to choose the teaching styles and methods that work best for them.

But this independence also can lead to isolation. During the typical work day, a teacher may spend only a few minutes with other adults. That can lead to stress, especially for younger teachers who are still learning how to deal with a wide variety of students' needs.

In a given classroom, a teacher may have two or three gifted students, three or four students with learning disabilities and several who do not speak English at home. It's tough to prepare lessons that meet the needs of such a wide range of students. That's why teaching is not a 9-to-5 job—many teachers work additional hours grading papers and planning lessons.

Most teachers have a 10-month contract, with two months off in the summer. During the two-month vacation, many teach summer school, take college classes or workshops to continue their education, or take another job. Some school districts have adopted a year-round schedule. Students and teachers attend school for 45 days at a stretch, followed by a 15-day break.

A recent nationwide survey of teachers found that most are concerned about three problems. Overwhelmingly, teachers say their schools do not get enough money to do a good job. They believe their classes are too crowded. And they worry that disruptive students are now absorbing most of their attention.

## How Do I Get a Job and Advance?

Most teachers in public schools need a bachelor's degree. They also must have completed an approved teacher education program in college and be licensed. Many states now require new teachers to pass a written examination before earning a teaching license. Requirements vary from state to state—some states require a master's degree.

Usually, college students who are planning to teach in elementary schools will major in elementary education. Those planning to teach at the secondary level will usually major in the subject they plan to teach and also will take a number of education courses. Most programs require student teaching (in actual classrooms) as well.

Once teachers have passed a probationary period—typically three years—they earn tenure. That means they cannot be fired without just cause and due process. Most states have tenure laws, which do not guarantee teachers jobs but do provide some job security.

Teachers who want to take additional coursework may become counselors, principals or specialists. In some school systems, excellent teachers have the opportunity to become mentors or master teachers. Usually these jobs give teachers additional responsibility—for example, they may be assigned to help new teachers—and carry a higher salary.

The National Board for Professional Teaching Standards offers voluntary national certification for teachers. Teachers who complete this rigorous program may earn more money in their school district. They also may find it is easier to find a job in another state.

## How Much Money Will I Make?

The average salary for all public school teachers is $37,900. Secondary school teachers (who are more likely to have master's degrees or Ph.D.s) usually earn more—the average salary is $38,600. Private school teachers usually earn less than teachers in public schools.

Salaries vary from state to state. The highest salaries tend to be in the Northeast (at $51,181, Connecticut's average salary is the highest in the nation); salaries in the South and the Midwest tend to be lower (South Dakota's average salary, the nation's lowest, is $27,072).

## To Learn More

For more information on teaching, including current salaries and other issues, contact the American Federation of Teachers, 555 New Jersey Ave. NW, Washington, DC 20001 (www.aft.org); or the National Education Association, 1201 16th St. NW, Washington, DC 20036 (www.nea.org).

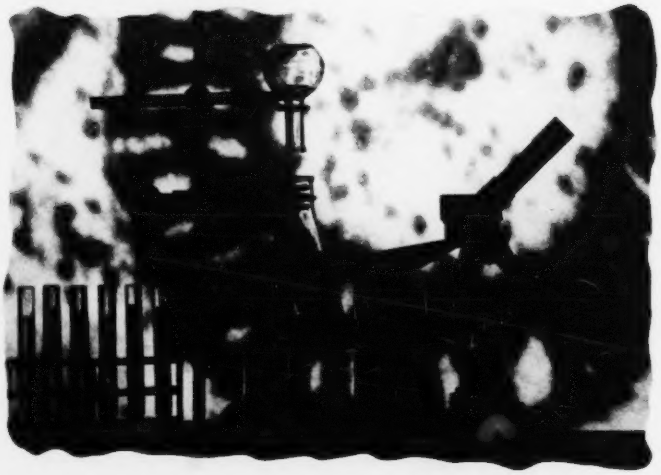
For information on special education—one of the fastest-growing careers in teaching, focusing on children who have disabilities and special needs—contact the National Clearinghouse for Professions in Special Education, Council for Exceptional Children, 1920 Association Drive, Reston, VA 20191 (www.cec.sped.org).

To learn about the requirements for becoming a teacher in your state, contact your state's department of education.

### Did You Know?

The thing teachers dislike most about their job is paperwork, according to surveys. They report spending about 20 percent of their time on this part of the job.

# Science Technicians



**Do you enjoy science but prefer practical applications to theory?**

**Do you work well as part of a team?**

**Do you have excellent written and oral communications skills?**

I have the best of both worlds," says Sue, a technician who works in an environmental health lab. "My work includes a lot of exciting science and discovery, and I did not have to obtain a four-year college degree."

Her comments reflect the attitudes of many science technicians. For people with an interest in science, especially in real-world applications of scientific principles, this is a rewarding and good-paying career.

## What's It All About?

Science technicians play an increasingly important role in most scientific research. As laboratory instrumentation and procedures have become more complex, it is necessary to have people who know how to set up labs, keep the equipment running, collect samples, interpret data and solve problems.

Typically, science technicians have jobs that are more practically oriented than those of many scientists. They set up, operate and maintain lab instruments. They monitor experiments, make observations and calculate and record results.

Other technicians work in production. They monitor manufacturing processes and may be involved in quality control—testing products for proper proportions of ingredients, purity or strength and durability.

Like most scientists, science technicians usually specialize in a particular scientific discipline.

*Agricultural technicians* work in food, fiber and animal research, production and processing. They conduct tests and experiments to improve the yield and quality of crops or to increase the resistance of certain plants to specific diseases or insects. Some do animal breeding.

*Biological technicians* work with scientists who study living organisms. These technicians may one day be part of a team that finds the cure for AIDS or cancer. They analyze organic substances such as blood, food and drugs. Some examine evidence in criminal investigations. Others work in biotechnology labs on such activities as gene splicing and recombinant DNA.

*Chemical technicians* work with chemists and chemical engineers. Some of these technicians collect and analyze samples of air and water to monitor pollution levels. Others work in chemical plants to operate equipment, monitor plant processes and analyze plant materials.

*Environmental technicians* conduct tests in the lab and the field to monitor environmental resources and determine contaminants and sources of pollution. They may collect samples for testing. They may be responsible for waste management or controlling hazardous materials. Many technicians in this field are

## Job Outlook

A 13 percent increase, to 258,000 jobs, by 2006. The growing number of agriculture and medical products developed through biotechnology will increase the need for biological technicians. Environmental concerns should mean more jobs for technicians who help regulate waste products and collect air, water and soil samples.

involved in pollution prevention.

*Petroleum technicians* measure and record physical and geologic conditions in oil or gas wells. They may lower instruments into the wells or analyze the mud that comes from the wells. They may test geologic samples to determine their petroleum and mineral content. Others, called scouts, collect information about oil and gas drilling operations or act as "prospectors," helping scientists searching for new oil resources.

Some science technicians work in the nuclear industry. Others collect weather information or help oceanographers.

Today, robots perform many routine tasks once performed by science technicians. That has freed the technicians to work on more sophisticated equipment, often computer-controlled. Science technicians make extensive use of computers, computer-interfaced equipment, robotics and high-tech industry applications like biological engineering.

### What's It Really Like?

There is no "typical" job for a science technician. One person may work regular hours in a lab. Another may spend most of her time in the field taking air or water samples. A third may need to work irregular hours to monitor experiments that can't be completed during a regular 9-to-5 workday.

That variety means there's a job that can fit almost anyone's needs. "There's a lot of opportunity in this field," says Carol, who works for a Fortune 500 chemical company. About one-third of all technicians—35 percent—work in manufacturing, mostly in the chemical and food processing industries. Many more work in research or educational institutions.

In addition to your skills as a scientist, you'll need communication and people skills. "Technicians work as part of a team where everyone must have good computer and communication skills," Carol says. "There's also the expectation that technicians will take a significant role in the project and do complex work. That makes the job rewarding and exciting."

There are some hazards in this job. You may be exposed to harsh or toxic chemicals. You may be exposed to radioactive isotopes. Nuclear technicians may be exposed to radiation, and biological technicians may work with disease-causing organisms or radioactive agents. But technicians who follow proper lab procedures are usually not at significant risk.

### How Do I Get a Job and Advance?

There are several ways to become a science technician. Most employers hire people with a two-year associate's degree. Some science technicians have a four-year degree in biology or chemistry, however.

"Here, technicians are, in essence, troubleshooters," says Phyllis, a technician who works for a power company. Her employer prefers to hire people with at least a B.S. degree, which she says is "more than adequate" for her position.

A one-year certificate program or a two-year associate's degree program are more typical routes into this field. Usually these programs combine the teaching of scientific principles and theory with practical, hands-on application in a lab setting with up-to-date equipment. As much as possible, science courses beyond high school should emphasize "bench" skills. Some programs combine internships with classroom experience, allowing students to get real-world experience before entering the job market.

If you are considering a career as a science technician, take as many science and math courses in high school as you can. Computer skills also are essential, as are English classes. Job experience in a lab, whether as an assistant or through an internship, is helpful.

Technicians usually start as trainees and work under the direct supervision of a scientist or a more experienced technician. As they gain experience, technicians take on more responsibility. Eventually, some become supervisors.

### How Much Money Will I Make?

The average salary for science technicians is about $27,000. Chemical technicians earn a little more—an average of about $31,000—and biological technicians earn slightly less (about $25,200 on average).

### To Learn More

For information about a career as a chemical technician, contact the American Chemical Society, Education Division, Career Publications, 1155 16th St. NW, Washington, DC 20036 (www.acs.org).

**Did You Know?**

Using genetic engineering scientists and science technicians are creating plants that are resistant to insects and diseases. For example a gene from peranthium, a South African plant that has no known insect predators and produces its own natural insecticides, has been genetically engineered into wheat and corn.

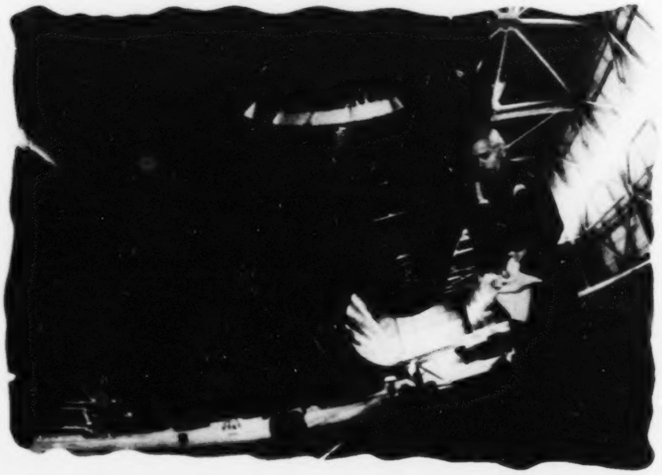
# Transportation

# Aircraft Mechanics

**Can you work well under pressure?**

**Are you a problem solver with good mechanical ability?**

**Are you precise and concerned with perfection in your work?**



Orville and Wilbur Wright never knew just what they started. Since their first flight, which lasted 12 seconds and covered only about 120 feet, the United States has become a nation that loves to fly. In 1996 alone, more than half a billion passengers flew on U.S. airlines. More than 8.2 million planes took off and landed—a number that rises every year.

Except in the rare case of a mechanical problem, most of those passengers never see the people who keep the planes in the air. If you are mechanically inclined and want a job with an excellent salary, you might consider a career as an aircraft mechanic.

## What's It All About?

Aircraft mechanics perform scheduled maintenance, make repairs and complete regular inspections of aircraft that range from the smallest single-engine planes to the huge jumbo jets that transport passengers across the continent. They follow a comprehensive list of scheduled maintenance and inspections set out by the Federal Aviation Administration (FAA).

Aircraft mechanics spend much of their time in preventive maintence—taking care of all the parts of the plane before they wear out or break down. They follow a maintenance schedule based on the number of hours the aircraft has flown or the number of days since the last repair. They inspect the engine, landing gear, instruments, pressurized sections and accessories (like brakes, valves, pumps and air-conditioning systems). They replace worn-out or defective parts.

Periodically, mechanics take the engine out of the aircraft and take it apart. Then they use precision instruments to measure parts for wear. They also use X-ray and magnetic inspection equipment to check for invisible cracks. Some of the larger planes have aircraft monitoring systems, consisting of electronic boxes and consoles, which monitor the aircraft's basic operations. These systems provide invaluable information to mechanics as they try to diagnose what may be causing a mechanical problem.

All the metal on an aircraft is subjected to severe stress. When a plane is in the air the outside temperature may be well below zero degrees Fahrenheit. Within 20 minutes, however, that same aircraft may land in a city where the temperature is over 100. These constant changes in temperature, combined with pressure changes and the stress of flying at hundreds of miles an hour, can cause tiny hairline cracks to form in the fuselage, tail or wings of the aircraft. Some mechanics are responsible for checking and repairing the metal parts of the plane.

Pilots also may report mechanical problems that must be repaired. Before

## Job Outlook

A 13 percent increase, to 155,000 jobs, by 2006. The greatest number of job openings will probably come at smaller commuter and regional airlines, where the pay tends to be lower than it is at the major carriers.

each flight, pilots go through a preflight check to make sure all instruments are working properly. If the pilot discovers, for example, that the fuel gauge for the rear engine isn't working, mechanics will be called in. They may use electrical test equipment to make sure no wires are broken or shorted out, and will then replace any parts or electrical components.

Mechanics may work on one or many different types of aircraft: jets, propeller-driven airplanes or helicopters. They may specialize in working on a particular section of the aircraft: the engine, hydraulic or electrical system.

*Powerplant mechanics* work on engines. They also may do limited work on propellers. *Airframe mechanics* may work on any part of the aircraft except the instruments, powerplants and propellers. *Combination airframe-and-powerplant mechanics*, called "A&P mechanics," may work on all parts of the plane except the instruments. You must get a certificate from the FAA to earn these designations.

*Avionics technicians* repair and maintain the components used for aircraft navigation and radio communications, weather radar systems and other instruments and computers on board the aircraft. These technicians may need additional licenses such as a radio telephone license from the Federal Communications Commission.

## What's It Really Like?

Every time mechanics work on an aircraft they have the safety of hundreds of passengers in their hands. So, in addition to their mechanical ability, aircraft mechanics need to be hard-working and responsible.

Mechanics work in hangars or other indoor areas. But if the hangar is full, or if repairs must be made quickly, they may work outdoors, not always in the best weather. You need to be able to work carefully and quickly, since you are responsible not only for making sure the aircraft is ready to fly, but also that it's ready on time. That combination of the need to maintain exacting safety standards and yet to stick to a time schedule can be stressful.

This isn't a job for someone who's afraid of heights—mechanics sometimes have to crawl around the top of wings and fuselages of large jet planes. Mechanics also may have to work in cramped or awkward positions as they try to inspect and repair all the parts of the airplane. They frequently must lift, push or pull objects that weigh as much as 70 pounds.

## How Do I Get a Job and Advance?

A few people become mechanics by learning their skills on the job. But by far the greatest number have learned their job in a trade school that is certified by the FAA. Students complete a minimum of 1,900 class hours. In these programs, which may last up to 30 months, students get practice working with the tools and equipment they'll use on the job. Typically, the classes emphasize new technologies such as turbine engines, aviation electronics and composite materials—graphite, fiberglass and boron—which are being used in the construction of new aircraft.

After 18 months on the job, or after completing a program at an FAA-certified mechanic school, mechanics can earn an FAA certificate as an airframe mechanic, a powerplant mechanic or an avionics repair specialist. The certificate also requires applicants to pass written and oral tests and demonstrate that they can do the work authorized by the certificate.

After at least 30 months of experience working with both engines and airframes, mechanics may earn an A&P certificate. Most airlines require that their mechanics have a high school diploma and an A&P certificate.

You can learn some of this trade in the armed forces, but usually military jobs are too specialized to provide the kind of experience you'll need to earn an FAA certificate. Military experience is still a big advantage when applying for a job, however. Employers like trade school graduates with military experience.

While you're in high school, take courses in mathematics, physics, chemistry, electronics, computer science and mechanical drawing. Writing skills are important, too, since mechanics often have to submit written reports.

Aircraft are constantly changing, and the FAA requires all mechanics to keep their skills up to date. Expect to take part in retraining programs throughout your career.

Mechanics may advance to become the lead mechanic. They also may become an inspector. With additional business and management training, some open their own aircraft maintenance businesses.

## How Much Money Will I Make?

The average salary for aviation mechanics is about $35,000, but some earn as much as $48,000. Mechanics who work on jets usually make more money than those who work on other aircraft.

## To Learn More

For general information on aircraft mechanics, contact the Professional Aviation Maintenance Association, 636 I ("Eye") St. NW, Suite 300, Washing-ton, DC 20001 (www.pama.-org) or the Association of Women in Aviation Maintenance, P.O. Box 1030, Edgewater, FL 32132 (www.galaxymall.com/retail-/retail/destiny/awam.html).

### Did You Know?

**One of the benefits of this job is the opportunity it can give you to travel. Airline mechanics and their families can usually travel for free or at a reduced rate on their own and other airlines.**

# Aircraft Pilots

**Have you always been fascinated with flight?**

**Can you make quick and accurate decisions?**

**Do you stay cool under pressure?**

*"O, I have slipped the surly bonds of Earth/And danced the skies on laughter-silvered wings."*

Those lines, from John Magee's poem "High Flight," sum up the almost magical feeling pilots say they get every time they take an aircraft up over the clouds. This high-paying job continues to have strong appeal to people who want to go up into the "wild blue yonder."

## What's It All About?

Pilots are highly trained professionals who are responsible for flying airplanes and helicopters. Most pilots fly passengers—either for scheduled or charter airlines—or transport cargo for freight carriers like United Parcel Service and Federal Express.

In all but the smallest aircraft, two pilots—a captain and a first officer—are in the cockpit together. The captain is in command of the entire flight crew, which on jumbo jets may include more than a dozen people. The first officer (or co-pilot) assists with tasks like monitoring instruments, communicating with air traffic control and actually flying the aircraft.

Work begins well before takeoff. Pilots start by checking the aircraft thoroughly to make sure everything from the fuel gauge to the wing flap control is in perfect working order. They also check the cargo to make sure it has been loaded properly. These preflight checks are essential for safety.

Pilots check with air traffic control, flight dispatchers and weather forecasters to find out about the weather at their destination and along their route. Based on that information, they determine the route they'll follow, the altitude at which they'll fly and the speed that should provide the fastest, safest and smoothest flight. In most cases the pilot files a flight plan with air traffic control so the flight can be coordinated with other air traffic.

Then it's time for the flight. Takeoff and landing are the two most dangerous times in any flight, and they're the times when the pilot and first officer must work together most closely. Usually the pilot flies the aircraft while the first officer checks instruments. The speed required to lift an aircraft from the ground depends on everything from the weight of the airplane and the speed and direction of the wind to the altitude of the airport and even the outside temperature. The moment the plane reaches takeoff speed, the first officer informs the captain, who then pulls back on the controls and raises the nose of the plane.

Most of the time the rest of the flight is relatively easy. Flight management computers and autopilot make it easy to keep an aircraft on course. Pilots still need to keep a watchful eye on the instrument panel, though, to make sure everything's working as designed and

## Job Outlook

**A 13.8 percent** increase, to **125,000 jobs,** by 2006.

that there will be enough fuel to get the plane to its destination.

If there's bad weather, however, pilots may need to change their route. In that event they must contact air traffic control to request permission to fly higher (or lower) to avoid the bad conditions.

In poor visibility pilots rely on instruments to guide the plane. Altimeters tell them how high above the ground they are and whether or not they can safely fly over mountains. Navigation radios connected to a satellite-powered global positioning system help pinpoint exactly where the aircraft is at any moment.

Some pilots have unusual jobs. They dust crops and spread seeds for reforestation. They direct fire-fighting efforts. They track criminals, or monitor traffic. They rescue and evacuate injured people or those who may have been lost in the wilderness. Some pilots test aircraft that are under development, and others teach students how to fly.

## What's It Really Like?

The job seems glamorous but it's also very hard work. Pilots must be in top physical condition. They are required by the Federal Aviation Administration (FAA) to have regular physical examinations. They also must continue to update their skills at training sessions and by flying a flight simulator.

This is anything but a 9-to-5 job. Airlines operate at all hours of the day and night, and flight assignments are based on seniority. So pilots who are just starting out can expect to fly nights, weekends and holidays. All airline pilots spend many nights away from home, although the airline does pay for their hotel, food and transportation to and from the airport while they're traveling.

By law, pilots cannot fly more than 100 hours a month or 1,000 hours a year. But when you add in the time spent in airports between flights, it totals many more hours than 100 per month. Most airline pilots spend about 75 hours a month in the air and another 75 in nonflying duties. They may suffer jet lag—fatigue caused by many hours of flying through different time zones.

There are, of course, many benefits to the job. In addition to the opportunity to do something they love, pilots enjoy high salaries and usually get free or reduced-fare air travel for themselves and their families.

This is a field that is increasingly opening up to women. "When I graduated from high school, airlines didn't have a single female pilot," says Sherri, a pilot for a major airline. In fact, it wasn't until 1973 that Emily Howell became the first woman hired to fly for a scheduled U.S. airline. At the time, Howell predicted in an interview, "It won't be long before there are other women flying for the airlines."

She was right. Although women today make up only about 6 percent of all pilots in the United States, statistics show that about 12 percent of current student pilots are women. Many of these young women may become tomorrow's airline pilots.

## How Do I Get a Job and Advance?

All pilots must have a commercial pilot's license with an instrument rating. You need at least 250 hours of flight experience to earn this first-level license. You also need to be in good physical condition and have excellent eyesight and hearing. You must pass a written test and demonstrate your flying ability to the FAA or an FAA-certified examiner. Although some airlines will hire people with only a high school education, most require at least two years of college and prefer college graduates. If your high school or vocational center offers courses that are aviation-related, take advantage of them. Math courses will help as well.

Many pilots first learn to fly in the armed forces. Military pilots fly both helicopters and jets. Employers know that they have experience flying in all kinds of difficult conditions.

If you haven't come out of the military, your first job will probably be with a small commuter or regional airline. You will start as a first officer, then advance to pilot. You may then be hired by a larger airline. Once you are employed by a major airline, your advancement will be by seniority.

## How Much Money Will I Make?

Earnings of airline pilots are among the highest in the nation. The average salary for pilots with six years of experience range from $28,100 at small turboprop airlines to nearly $76,800 at the largest airlines. Some senior captains on the largest aircraft earn as much as $200,000. Corporate helicopter pilots earn between $47,900 and $72,500, while commercial helicopter pilots earn between $33,000 and $59,000 a year.

## To Learn More

For information on airline pilots, contact the Airline Pilots Association, 1625 Massachusetts Ave. NW, Washington, DC 20036 (www.alpa.org); or the Air Transport Association of America, 1301 Pennsylvania Ave. NW, Suite 1110, Washington, DC 20006 (www.air-transport.org).

For information about careers for women as aircraft pilots, write to Women in Aviation, Morningstar Airport, 3647 S.R. 503 S., West Alexandria, OH 45381 (www.wiai.org).

For information on helicopter pilots, contact the Helicopter Association International, 1619 Duke St., Alexandria, VA 22314 (www.rotor.com).

### Did You Know?

**The world's busiest airport is Chicago's O'Hare, with more than 69 million passengers annually. The airport that handles the most cargo (1.9 million tons per year) is Tennessee's Memphis International because it is the headquarters of Federal Express.**

# Automotive Body Repairers

**Are you meticulous and precise?**

**Do you enjoy working with tools?**

**Are you looking for a physical job?**

You borrowed your father's car ... and promptly crunched the right front fender. You stopped at the stop sign but the car behind you didn't. Now your car has a crumpled rear end.

Each day, thousands of motor vehicles are damaged in traffic accidents. Sometimes the damage is so severe that the vehicle is beyond repair. More often, though, it can be repaired so it looks like new.

Automotive body repairers are the people who straighten bent bodies, remove dents and replace the crumpled parts that are beyond repair. As long as there are people who get themselves and their vehicles into accidents, there will always be a need for people in this occupation.

## What's It All About?

You had an accident. Your insurance company has authorized you to get the car repaired. Now what happens?

Usually, you'll take the car to a car dealer or a shop that specializes in body repairs. There, a supervisor will examine your car carefully to determine which parts can be restored and which must be replaced.

Then the automotive body repairer starts to work. One of the most important parts of the job is checking to see whether the accident damaged the frame of the car. First, the repairer makes careful measurements to see if the car is out of alignment, and, if so, by how much. Then special machines use hydraulic pressure to restore the frame to its original condition. If a car is even slightly out of alignment, tires may wear unevenly. In more serious cases the steering can be affected.

After the frame is back in shape the repairer starts to work on the body of the car. Less serious dents can be pulled out with a hydraulic jack or a hand prying bar. Others can be knocked out with hand tools or pneumatic hammers. Some small dents or creases can be smoothed out by holding a small anvil against one side of the damaged area and hammering on the opposite side. Tiny indentations can be removed with pick hammers and punches—a process known as metal finishing.

Of course, some parts cannot be repaired. Instead, they must be removed (usually with a pneumatic metal-cutting gun) and a new part must be welded in place.

Many car manufacturers now use plastic for some body parts. Sometimes these can be repaired by applying heat from a hot-air welding gun or by placing the plastic part in hot water and then pressing the softened plastic back into shape by hand.

If there are small dents that cannot be worked out of the plastic or metal panel, the repairer will use solder or plastic to fill these dents. Then they'll be sanded

## Job Outlook

**A 13 percent increase, to 254,000 jobs, by 2006. Demand is expected to increase as the number of motor vehicles grows. In addition, lighter-weight designs make today's cars more prone to damage than older, heavier vehicles.**

smooth before painting. In small shops that's the job of the automotive body repairer, but in larger shops there are likely to be people who specialize in painting.

## What's It Really Like?

This is a job that requires precision and an eye for detail. You need precision to make accurate measurements when repairing the frame of a vehicle and an eye for detail to judge whether you have restored the damaged part so well that no one will be able to tell the car was damaged in the first place.

Although most automotive body repairers today are men, it's a career women should consider, says Ron Weiner, president of the National Institute for Automotive Service Excellence. "Challenging careers as automotive service professionals are not gender-specific," he comments. "Servicing and repairing today's vehicle requires more brainpower than brawn."

Generally you can expect to work a standard 40-hour week, but people in business for themselves often work longer hours. It's indoor work, although all that hammering and those power tools make the shop pretty noisy. You may need to work in cramped or awkward positions, and you can expect to get dirty.

There's a lot of variety in this job. Each vehicle is different, and each requires you to use different methods to repair the damage.

There are some potential hazards—burns from torches and heated metal, injuries from power tools, cuts from sharp metal edges, fumes from paints. But there's also the great feeling that comes from seeing a car you've restored to its original condition. "I've had customers tell me, 'It doesn't just look new, it looks better than new,'" says Ernie, who runs his own auto body shop.

As with other automotive jobs, you'll need to buy your own hand tools. Many automotive body repairers have invested thousands of dollars in their tools.

## How Do I Get a Job and Advance?

Employers are looking for people who have completed a formal training program in automotive body repair. That training is important because advances in technology have led to incredible changes in the materials used in manufacturing automobiles. Instead of the traditional steel, today's automobile bodies are likely to be made of a combination of materials, each of which requires a slightly different technique to reshape it. You can enroll in auto body courses in high school or in a vocational school or community college.

You can still enter this profession as a helper and learn your skills on the job, although it's likely to take you more time to get the training you need. As a helper, you'll start by learning to remove small dents and make other minor repairs. If you choose this route, you should expect to spend three or four years learning the skills you'll need.

Whether you take a formal course or learn on the job, there are some basic skills you'll need. These include good reading and excellent math skills, since you need to follow instructions and diagrams in technical manuals precisely.

You can be certified by the National Institute for Automotive Service Excellence. Certification requires you to pass a test and to have at least two years of experience. Even if you don't pursue certification, plan on continuing your education on the job. As technology changes the way automobiles are made, you'll need to keep learning to keep up with these changes.

Experienced automotive body repairers may become shop supervisors. Others may open their own body repair shops or become an automobile damage appraiser for an insurance company.

## How Much Money Will I Make?

The average salary for an automotive body repairer is about $24,000, although many shops pay workers on an incentive basis. This allows people who work quickly or who can handle more complicated repairs to earn more money.

## To Learn More

For general information about automotive body repairer careers, contact the National Automobile Dealers Association, 8400 Westpark Drive, McLean, VA 22102; (703) 821-7000 (www.nada.org). For information on certification, as well as a "virtual toolbox" that will introduce you to many of the skills you'll need for this profession, contact the National Institute for Automotive Service Excellence, 13505 Dulles Technology Drive, Herndon, VA 22071 (www.asecert.org).

### Did You Know?

**While the total number of women in the auto repair profession is small, the rate of increase over the past few years is significant. In just two years, from 1994 to 1996, the number of female technicians rose by 22 percent while the number of male technicians increased by just 3 percent, according to the U.S. Department of Labor's Bureau of Labor Statistics.**

# Automotive Technicians

**Do you love to fix cars?**

**Are you a good problem solver?**

**Can you work with technical equipment?**

*"It makes a whining sound when I put on the brakes."*

*"The engine seems to stall when I go up a hill."*

*"It just stopped running."*

Those are the kinds of problems drivers bring to automotive technicians every day. Customers who may have very little idea how a car operates trust their technician to tell them what's causing the problem—and to know how to fix it.

For those who can figure out what's wrong with an automotive vehicle and correct the problem, job opportunities are excellent. Nearly 100,000 new positions are expected to open up in the field by 2006.

## What's It All About?

When a vehicle isn't working properly, the technician talks to the owner to find out what problems the vehicle is experiencing. If the technician works in a large shop, a service estimator may have taken that information and translated it into a work order. The technician may need to take the vehicle for a test drive or look under the hood.

Modern technology also helps. In some shops, technicians use electronic service equipment, such as an infrared engine analyzer, to figure out what's wrong. Other computerized diagnostic devices are hooked up to huge computerized databases that can identify the problem and make precise adjustments.

But of course, technology may be the source of the problem. A new car today has from 10 to 15 onboard computers that operate the radio, brakes, steering systems and a variety of other components. Technicians must know enough about electronics to be able to recognize when an electronic malfunction may be causing the problem.

Once the trouble is identified, technicians must know how to fix it. They may consult the manufacturer's service information about the vehicle or technical service bulletins that highlight specific problem areas. In some cases, this information may be accessible through a computer terminal right in the shop area.

Technicians in many shops have become specialized. Some deal with front-end alignment and repair steering mechanisms and suspension systems. Others specialize in tune-ups, using electronic test equipment to locate and test malfunctions in fuel, ignition and emissions control systems. Additional specialties include automatic transmissions, air conditioning and radiators.

## What's It Really Like?

Technicians work for quick-service shops, independent repair shops and car dealerships. But wherever they work, they're likely to go home at night with

## Job Outlook

**A 12 percent increase**, to 871,000 **jobs, by 2006.**

dirty hands. From changing the oil on a brand-new sport utility vehicle to replacing the water pump on a 1982 station wagon, you'll be working with mechanical parts that are dirty and greasy.

Sometimes technicians do routine service. They follow a checklist to make sure they examine all the important parts. Belts, hoses, plugs, brake and fuel systems and other potentially troublesome items are closely watched.

On larger repairs, technicians must use their best judgment. Once they identify the cause of the problem, they make a recommendation to the vehicle's owner. Can the part be repaired, or must it be replaced?

Technicians need to be able to work independently. "Attitude is as important as aptitude," says Tim, who owns a business specializing in repairing Asian automobiles. Not only do technicians need to know what goes on under the hood of a car or truck, they also have to be responsible and willing to work.

Technicians use a variety of tools in their work. Power tools like pneumatic wrenches make quick work of the chore of loosening the bolts on a wheel. Machine tools like lathes and grinding machines allow mechanics to rebuild brakes. Welding and flame-cutting equipment may be necessary if the exhaust system has to be replaced. At other times, however, basic hand tools like wrenches and screwdrivers are all it takes to make engine adjustments.

Technicians usually own their own hand tools, and these may be among their most valuable possessions—sometimes worth thousands of dollars. Beginners usually accumulate a set of tools as they gain experience.

Most technicians work a 40-hour week, although self-employed technicians often work longer hours. A growing number of repair businesses are open nights and weekends to accommodate the schedules of two-worker families.

## How Do I Get a Job and Advance?

This is a field that is rapidly becoming more technological. There are, of course, some technicians who learn the trade just by helping and working with experienced technicians. But most employers today want to hire people who have completed some formal auto training—especially a postsecondary program.

Even for trainee positions, most employers want people with a high school diploma. High school courses in automotive repair, electronics, physics, math, chemistry, computers and English provide a good educational background.

There are many high school programs in auto technology, but many of these do not offer the combination of hands-on experience and classroom instruction that is necessary to work on today's sophisticated vehicles. If the program is one of the approximately 1,250 high school and postsecondary auto technician training programs that's certified by the National Automotive Technicians Education Foundation (NATEF), however, it meets certain standards for instructional facilities, equipment, staff credentials and curriculum. A limited number of high schools participate in Automotive Youth Educational Systems (AYES), a partnership between schools and local dealerships that offers the kind of classroom/on-the-job training combination employers are seeking. Also, some high schools have joined with community colleges and vocational schools to offer tech prep courses in automotive technology.

Postsecondary training programs usually last from six months to two years. During that time, students practice new skills and learn the latest automotive technology. Typically, students alternate periods of classroom study with full-time internships in the service departments of automobile dealers.

Beginners usually start as trainee technicians. They may do routine service tasks and make simple repairs. It may take from two to five years to become a journey-level service technician who is qualified to do the more complex repair jobs. However, graduates of better postsecondary mechanical training programs may advance to this level after only a few months on the job.

There is a need for constant retraining. Employers may send technicians to the manufacturer's training center so they can learn how to repair new models or make specialized repairs. Automotive technicians can qualify for certification by the National Institute for Automotive Service Excellence (ASE).

Experienced technicians may become a shop supervisor or a service manager. Others may open their own business or become the owner of a franchised quick-service repair shop.

## How Much Money Will I Make?

The average salary for automotive technicians is about $24,800. Many master technicians earn as much as $70,000 to $100,000.

## To Learn More

For a list of certified automotive technician training programs, contact the National Automotive Technicians Education Foundation, 13505 Dulles Technology Drive, Herndon, VA 22071; (703) 713-0100.

For information on becoming a certified automotive technician, contact Automotive Service Excellence, 13505 Dulles Technology Drive, Herndon, VA 22071; (703) 713-0100 (www.route 66.com/ASE.html).

Automobile manufacturers sponsor two-year associate degree programs in automotive technology. These include:

- Ford Automotive Student Service Educational Training (ASSET) Program, Ford Customer Service Division, Fairlane Business Park III, 1555 Fairlane Drive, Allen Park, MI 48101; (800) 272-7218
- Chrysler Dealer Automotive Program (CAP), National CAP Coordinator, CIMS 423-21-06, 26001 Lawrence Ave., Center Line, MI 48015; (800) 626-1523
- General Motors Automotive Service Educational Program (ASEP), National College Coordinator, General Motors Service Technology Group, MC 480-204-001, 30501 VanDyke Ave., Warren, MI 48090; (800) 828-6860

For information on becoming a franchisee of a quick-service repair shop, visit www.franchisesolutions.com or its business links.

### Did You Know?

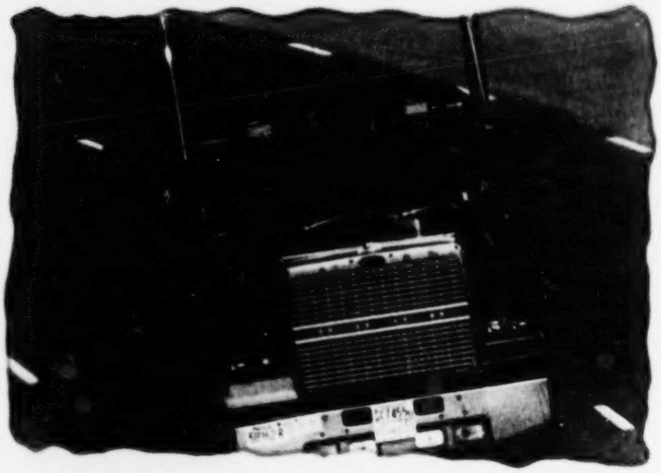
**There are more computers aboard a car today than there were on the first spaceships.**

# Diesel Engine Technicians

**Do you like to work with tools?**

**Are you mechanically inclined and know how to fix things?**

**Are you careful and precise?**



Diesel engines are workhorses that help power our nation's economy. In 1995 alone, diesel-powered trucks hauled 5.6 billion tons of freight over more than 161 billion miles, delivering goods to every community in America.

In addition to powering heavy trucks, diesel engines also provide the power for bulldozers, cranes, road graders, buses and locomotives. Keeping those engines in good working repair is important to our nation's economy. Diesel engine technicians are the people who get the job done.

## What's It All About?

Diesel engine technicians repair and maintain diesel engines. Because these engines deliver more power per unit of fuel than other engines and because they are more durable, they are preferred for such heavy-duty tasks as hauling freight, building roads and powering farm machinery.

It's important to keep diesel engines in good working order, so technicians spend a lot of their time on routine maintenance. They follow a checklist that includes inspecting brakes, steering mechanisms, wheel bearings and other important parts. Then diesel technicians will adjust, repair or replace any parts that are not working properly. They also perform other routine maintenance, like lubricating parts.

Diagnosing problems is an important part of technicians' job. Handheld computers assist them as they diagnose problems and adjust engine functions. Other computerized testing equipment can help them pinpoint and analyze malfunctions in electrical systems and engines.

In some shops diesel technicians do all kinds of repairs. One day a technician may work on a truck's electrical system, and the next perform a major engine repair. But in larger shops, technicians usually specialize in one or two types of work from among major engine repair, electrical systems or suspension and brake systems.

They use a variety of tools in their work. Pneumatic wrenches make it easy to remove bolts quickly. Lathes, grinding machines and other machine tools can help rebuild brakes. Welding and flame-cutting equipment is useful when a technician is working on an exhaust system. Technicians also use hand tools—screwdrivers, pliers and wrenches—to work on small parts.

## What's It Really Like?

You're bound to get dirty in this job. Engine parts are greasy and dirty, and technicians spend their day with their hands in, on or around them. Minor cuts, bruises and burns are also an everyday part of the job. You should expect to lift heavy parts and tools and

## Job Outlook

An 8.2 percent increase, to 288,000 jobs, by 2006. There is a shortage of diesel engine technicians who have completed formal programs, so these individuals are always in demand.

to stand or lie in awkward positions as you repair vehicles and equipment.

As with other mechanical jobs, diesel engine technicians usually own their own hand tools. Some senior technicians may have thousands of dollars invested in their tools. Employers usually provide the expensive power tools, computerized engine analyzers and other diagnostic equipment, however.

Most technicians work indoors, and most shops are well lighted, heated and ventilated. Most shops pay close attention to safety procedures, so serious accidents are unusual. A majority of technicians work a standard 40-hour week, but some shops have expanded service hours. Bus and truck companies, which need to keep their fleet of vehicles on the road, sometimes operate around the clock, although technicians usually earn higher pay for working nights and weekends.

Technicians may work as part of a team, especially if they're doing heavy work like repairing an engine or a transmission. Sometimes a senior technician may have a helper or apprentice.

If you're mechanical and like to work with your hands, you can get a lot of satisfaction in this job. If something's broken, you can fix it. You can get the tractor working again so the farmer can plow his field. You can fix the truck so the delivery goes through on schedule. And often you can prevent problems before they occur.

"What I like best," says Ed, a technician who specializes in school bus repair, "is finding and fixing a problem before it turns into a problem. If a school bus breaks down, you have 40 kids stranded and lots of families wondering where their kids are. If I can prevent that by replacing a part that's about to go bad, I know I've done something worthwhile."

## How Do I Get a Job and Advance?

People still learn diesel mechanics on the job, but employers prefer to hire people who have gone through a formal training program after high school. Community colleges and trade and vocational schools offer programs in diesel repair. These one- or two-year programs give you a foundation in the latest diesel technology. They also show you how to service and repair the vehicles and equipment you're likely to find on the job. Employers work closely with training programs to make sure graduates have the experience they need with the equipment, techniques and tools they'll find once they are on the job. Usually these graduates advance quickly to the journey technician level.

Technicians need to know basic electronics, since many diesel engine operations are now controlled by electronic components. They also need good communication skills, since technicians need to read and understand technical manuals, listen to customers as they describe what's wrong with the engine and communicate with other technicians in the shop.

You can learn this trade on the job, although it will take you several years. You'll start doing simple tasks: cleaning parts, fueling and lubricating vehicles, driving vehicles in and out of the shop. You'll be promoted first to a technician's helper. After several years, you can advance to the journey technician level.

While you're in high school, take courses in automotive repair, electronics, English, mathematics and physics. Practical experience, even as a hobby, is helpful, too.

Once you're on the job, you'll be expected to continue your education. Often, employers send technicians to special training classes so they can learn the latest technology and repair techniques.

The National Institute for Automotive Service Excellence provides voluntary certification for diesel technicians. Certification is offered in six different areas: brakes, gasoline engines, diesel engines, drive trains, electrical systems and suspension and steering. Candidates must pass a written examination and have at least two years of experience, although graduates of a training program can substitute education for part of the experience requirement.

Technicians can advance to become shop supervisors or service managers. Some open their own repair shops.

## How Much Money Will I Make?

The average salary for a diesel technician is about $28,300. The top 10 percent in salary earn considerably more, however—an average of about $42,000. Earnings vary by industry and geographic location.

## To Learn More

For general information about a career as a diesel technician, contact the Automotive Service Industry Association, 25 Northwest Point, Elk Grove Village, IL 60007; or the American Trucking Associations, Maintenance Council, 2200 Mill Road, Alexandria, VA 22314 (www.truckline.com).

For a directory of trade and technical schools with training programs for diesel technicians, contact the National Automotive Technicians Education Foundation, 13505 Dulles Technology Drive, Herndon, VA 22071 (www.ascert.org). For a directory of public training programs for diesel technicians, contact the Vocational Industrial Clubs of America, P.O. Box 3000, 1401 James Monroe Highway, Leesburg, VA 22075 (www.vica.org).

### Did You Know?

**The diesel engine takes its name from inventor Rudolph Diesel. He wanted to prove that fuel could be ignited without a spark. He was successful—but almost too much so. The fuel in the first engine not only ignited, but exploded and nearly killed him. Luckily, he worked out the safety problems in later versions.**

# SOURCES

Most of the career information in this guide was taken from the *Occupational Outlook Handbook*, 1998-99 edition, published by the Bureau of Labor Statistics, U.S. Department of Labor.

Additional career information came from a variety of trade associations, trade publications, surveys and interviews with people in the field. Information was provided by the Air-Conditioning & Refrigeration Institute, the Airline Pilots Association, the American Academy of Physician Assistants, the American Association for Respiratory Care, the American Chemical Society, the American Water Works Association, the American Dental Hygienists Association, the American Health Information Management Association, the American Occupational Therapy Association, the American Nurses Association, the American Physical Therapy Association, the Association of Surgical Technologists and the Construction Management Association of America.

Also, the Council on Library/Media Technicians, the Electronics Technicians Association, the National Association of Emergency Medical Technicians, the National Education Association, the National Federation of Paralegal Associations, the National Institute for Automotive Service Excellence, the National Retail Federation, the National Restaurant Association, the National Tooling and Machining Association, the Opticians Association of America, the Printing Industries of America, Sales and Marketing Executives International, the Society of Nuclear Medicine-Technologist Section, and the United Association of Journeymen and Apprentices of the Plumbing and Pipefitting Industry of the United States and Canada.

Additional facts were taken from the *New York Times 1998 Almanac* and the *World Book Encyclopedia.*

Most earnings data were culled from the Bureau of Labor Statistics and reflect median earnings in 1996. Additional information on earnings was provided by trade associations, trade publications and surveys. Providing earnings information were such groups as the American Health Information Management Association, the American Federation of Teachers, the National Federation of Paralegal Associations, the National Tooling and Machining Association, Sales and Marketing Executives International and the Utility Workers Union of America.

## For help in networking and gaining the skills you'll need to land a high-skill, high-wage job, check out the following vocational student organizations:

- *Business Professionals of America.* BPA is a co-curricular organization designed to meet the needs of middle school, high school and postsecondary students enrolled in school-to-careers, vocational business and office education programs. 5454 Cleveland Ave., Columbus, OH 43231 (800-334-2007). Web: http://www.bpa.org

- *Future Business Leaders of America.* FBLA serves students who are interested in pursuing business careers. It is dedicated to serving each member by developing the qualities necessary to become a successful business leader, conveying an understanding of the private enterprise system and encouraging patriotism and civic involvement. 1912 Association Drive, Reston, VA 20191-1591 (800-325-2946). Web: http://www.fbla-pbl.org

- *Future Homemakers of America (FHA/HERO).* The only organization of its kind focusing on family issues, FHA/HERO uses individual and team projects to provide leadership opportunities, develop critical thinking and decision-making skills and recognize student achievement. 1910 Association Drive, Reston, VA 20191 (800-234-4425). Web: http://www.fhahero.org

- *Health Occupations Students of America.* HOSA promotes career opportunities in the ever-expanding health care professions while enhancing the delivery of quality health care for everyone. HOSA provides a variety of classroom and community-based educational experiences and 40 health care-related competitive events. 6309 N. O'Connor Road, Suite 215, Irving, TX 75039-3510 (800-321-HOSA). Web: http://www.hosa.org

- *National DECA.* An integral part of marketing education, DECA enhances the training of students with interests in marketing, management and entrepreneurship. It promotes competency-based, competitive marketing events and achievement/recognition activities at the local, state and national levels. 1908 Association Drive, Reston, VA 20191-1594 (703-860-5000). Web: http://www.DECA.org

- *National FFA Organization.* A student organization of more than 444,000 members preparing for careers in the science, business and technology of agriculture. FFA makes a positive difference in the lives of students by developing their potential for premier leadership, personal growth and career success through agricultural education. 6060 FFA Drive, Indianapolis, IN 46268 (317-802-6060). Web: http://www.FFA.org

- *Skills USA/VICA.* Its goal is to develop employability, participatory and quality skills to complement the occupational skills developed by students in technical education classrooms or work-based learning sites. 14001 James Monroe Highway, Leesburg, VA 22075 (703-777-8810). Web: http://www.VICA.org

- *Technology Student Association.* TSA promotes technological literacy among students by enhancing their knowledge and experience through exposure to emerging technology and achievement in community and service projects, leadership skills development, technology-based competition and team-focused activities. 1914 Association Drive, Reston, VA 20191 (703-860-9000). Web: http://tsawww.org

# OTHER CAREER EXPLORATION RESOURCES FROM AVA!

## Informational Brochures for Students and Parents

(Available in sets of 100 or more)

- ***Will My Kid Get a Life? A Parent's Guide to Career Exploration***, a hands-on, how-to resource for parents unsure how to best and most productively lend their support and guidance.
- ***Learning and Earning Power: A Student Guide to Education Beyond High School***, a fact-filled guide for students on the benefits of their various education and training options after high school.
- ***About ... Preparing for a Career***, an AVA/MetLife collaboration for students that features illustrations of the "Peanuts" gang in career exploration situations.
- ***You Can Be What You Want to Be***, designed for middle and early high school students and featuring popular career quizzes covering all major vocational-technical education fields.
- ***8 Facts Every Parent Should Know About Vocational Education***, which stresses that a blend of academic and technical courses makes learning more meaningful and fun.
- ***Preparing Your Teen for a Successful Career: 10 Tips for Parents***, which looks at 10 specific ways parents can help their children move from school to career.

*To order these brochures or additional copies of* High-Skill, High-Wage Jobs, *call AVA Product Sales toll-free at 800-826-9972.*

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